APPARATUS FOR DETERMINING PERFORMANCE-INDICATING NUMBERS IN SPORTS GAMES, PARTICULARLY IN ICE-HOCKEY

This application is a continuation-in-part of U.S. Patent Application No. 08/664,406, filed June 17, 1996, abandoned, which is a continuation of U.S. Patent Application No. 08/116,249, filed September 2, 1993, now U.S. Patent No. 5,527,033, dated June 18, 1996, which is a continuation-in-part of U.S. Patent Application No. 07/579,410, filed September 7, 1990, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The field of this invention is an apparatus for determining "performance-indicating numbers" applicable in a variety of fields, such as life sciences, e.g. biology and medicine, games of all kinds, including military games, and all kinds of scoring or evaluation of sports, although this particular application is specifically geared to performance-indicating numbers in ice-hockey games.

2. Description of Related Art

Searches were conducted in the arts of computer simulation, sports statistics, and kits. The results of these searches are summarized below.

Sobotka et al, U.S. Pat. No. 5,197,004, issued Mar. 23, 1993, filed May 8, 1989, as Ser. No. 349,028, and relating to a method and an apparatus for automatic categorization of applicants from resumes, relates to a method and an apparatus for automatically selecting job categories within which an applicant should be placed, using only the applicant's resume.

The closest Sobotka et al come to the present patent application is a part of the main claim (claim 1) in which they recite . . . "summing the weights for each job category; selecting the job category or categories with the highest weights; and delivering as output either computer-compatible or text form the job category or categories with the highest weights." Sinn, U.S. Pat. No. 4,133,031, issued Jan. 2, 1979, filed Apr. 4, 1977, relates to an electronic speed rating calculator and method. Sinn discloses an apparatus and a method for calculating a comparative speed rating for an entrant in a race, such as a horserace, so that the entrant's performance can be compared with the performance of other entrants.

Although the methodology of Sinn '031 could conceivably be applied to the subject matter of the present invention, the implementation of his method and apparatus is quite different from applicant's.

Sobotka et al, U.S. Pat. No. 5,164,899 relates to a method and apparatus for computer understanding and manipulation of minimally formatted text documents, such as resumes, purchase forms insurance forms, bank statements, etc. The invention manipulates the digital image of a document, converting each block into an ASCII character file. The manipulated text is either stored or outputted in a form which facilitates its use and readability.

Sobotka et al, U.S. Pat. No. ~~5,345,930~~ 5,164,899, filed May 1, 1989, also relates to a method and apparatus for use with a computer, which analyzes text documents using both sophisticated text pattern matching techniques which are insensitive to typographical errors, and spatial analysis techniques for analyzing the spatial structure of the text document.

Pardo et al, U.S. Pat. No. 4,398,249, issued Aug. 9, 1983, filed Aug. 12, 1970, as Ser. No. 63,185, relates to a process and apparatus--compiler program--carried out on a digital computer for converting a source program into an object program. The source program is entered into a first storage area of a computer. The

symbolic source program is preferably first codified into a computer executable code by the compiler program.

The compiler program examines each formula repeatedly whether it has been identified, until all formulas have been defined. Its output is an object program which is executable by the computer.

Samuelson, U.S. Pat. No. 4,858,120 issued Aug. 15, 1989, filed Mar. 19, 1987, as Ser. No. 27,359, relates to a method for controlling arrival of servers; it includes measuring durations of service, estimated expected duration of service, estimated expected transit time, determining time in progress of each service, determining a number of currently busy servers expected to be available when by that time another arrival could reach them; computing total number of servers expected to be available; and controlling a means to correspond to the resulting number of servers expected to be available.

Scuorzo, U.S. Pat. No. 4,852,742, issued Aug. 1, 1989, filed Dec. 8, 1988, as Ser. No. 281,533, relates to a housing kit, which provides for rotation of a toothbrush head for mixing baking soda and an oxygenating agent within the housing kit. Provisions are made for maximizing the housing during use.

Ricigliano, U.S. Pat. No. 5,203,56, issued Apr. 20, 1993, filed Nov. 15, 1991, as Ser. No. 792,636, relates to an indoor miniature golf game having a plurality of fairways and greens.

Sequential visual activity segments with intermediate target areas are provided on the fairways between the tees and the greens. Various materials both visually and physically simulate the landscape, so that the golf ball travels quickly over the greens, but is slowed down and caught by rough or water-simulated areas.

Johnson, U.S. Pat. No. 5,153,826, issued Oct. 6, 1992, filed Nov. 28, 1989, Ser. No. 442,315, relates to a hand-held, portable device for keeping track of the in-play and error shots of a specific type of shot made by a player in a sports event. It comprises at least a first display for indicating at least the percentage of the cumulative number on in-play shots relative to the cumulative number of the total in-play and error shots; a first key switch for inputting each in-play shot; a second key switch for inputting each error shot; and a microprocessor for keeping track of the total number of in-play and error shots, and for calculating at least the percentage of the cumulative number of the in-play shots relative to the cumulative number of the shots made by the player, whereby the percentage display is updated each time one of the first and second keyswitches is depressed.

Pearson et al, U.S. Pat. No. 5,018,736, filed Oct. 27, 1989, as U.S. Ser. No. 428,866 relates to an interactive contest system

which permits competition among a plurality of remote participants.

The system includes a central controller, storage devices for storing a Contest Roster, from which each participant selects a team roster, a plurality of Touch-Tone.TM. telephones linked to the controller, and a publication such as a newspaper distributed to all participants. Each participant's team roster is evaluated on a periodic basis according to a formula for calculating each member's score employing a database of variable performance statistics which reflect the roster members' actual performances. Team roster totals are compared for discrete periods of competition to determine which participants have accumulated the highest score. This invention, although broadly similar to the present invention, implements the results totally differently.

Hendricks, U.S. Pat. No. 5,062,381, issued Nov. 5, 1991, filed Aug. 29, 1990, as Ser. No. 575,375, relates to a game data board. The board has an upper surface and a lower surface; a first marking slide; a first passage in the upper surface for receiving the first marking slide and for permitting movement of the first marking slide therein; and a second marking slide with arrangements similar to the first marking slide. Indicia on the bottom surface of the first passage indicate scores or statistics for at least one sport or game.

Rudnick et al, U.S. Pat. No. 4,977,503, issued Dec. 11, 1990, filed Oct. 28, 1988, Ser. No. 259,160, relates to a small hand-held electronic device containing all of the normally interesting statistics relating to baseball or football players and teams.

The system electronics include a microprocessor and a large solid state non-volatile memory array containing the detailed statistical records. In a baseball embodiment, the user turns on the device and selects a player or team by entering two or three characters of the name via alphabet keys. The device displays the cumulative statistics; previous year statistics are displayed by the use of cursor keys. A new statistic may be obtained by pressing a key corresponding to that statistic, while a new player or team may be selected by depressing the first two or three letters of the name and the beginning of the process anew.

Hovorka, U.S. Pat. No. 4,292,507, issued Sep. 29, 1981, filed Mar. 9, 1978, Ser. No. 884,762 relates to a calculating and recording device for determining and retaining play statistics of a football game. In a preferred embodiment marker means include a plurality of varied color, shape or size of pegs and/or cooperative rings, each of which represents a certain type of passing, rushing or kicking play, first down or other statistics, and the like, and a rule is provided with sufficient receiver capability to record substantially all of the plays made by a team in a single quarter of half of the football game. A receiver is

also employed for locating removable markers in a groove which receives the slide, thereby permitting markers to be placed indicative how each drive ends, and providing a reference stop for the slide and permitting its use for indicating the number of plays in the present drive. The markers also permit identification of each play in a series of plays, such as first, second, third or fourth down play.

It has been possible to obtain selected performance statistics, for example, of a team engaged in competitive hockey scores, by extensive manipulation from a box score, generally provided by newspapers, but to the best of applicant's knowledge, no apparatus existed up to the date of writing, where this manipulation was performed either automatically, or at least semi-automatically by a machine. The present application seeks to remedy this shortcoming.

REFERENCE TO COPYRIGHTED MATERIAL

The present invention makes use of certain text and mathematical formulas, which formulas are subject to Applicant's copyrighted information contained in Applicant's computer program and user's manual, as protected by Copyright Registration number TXU 578 944 of Jul. 23, 1993, entitled "Hockey: Special Teams Statistics/Time Frame Basis."

REFERENCE TO APPENDIXES

Attached hereto as Appendix I, at pages 1A-18A, are the rules governing the game of ice hockey, which rules are applied during use of the subject matter of the present invention.

Attached hereto as Appendix II is a typical hockey game box score.

Attached hereto as Appendix III is a computer generated print out of the output of the typical hockey game box score of Appendix II, after utilizing the subject matter of the present invention.

BASIS FOR THE INTERMEDIATE FORMULAE IN THE APPARATUS ACCORDING TO ONE EMBODIMENT OF THE INVENTION

Composite Power Play

$$((D5)+(2*G5)*(60)+(E5)+(2*H5)/(B5)/(60)Int*(60.6))$$

B=Total power play goals scored by a team.

D=Accrued number of minutes in which a team has a one player advantage.

E=Accrued number of seconds in which a team has a one player advantage.

G=Accrued number of minutes in which a team has a two player advantage.

H=Accrued number of seconds in which a team has a two player advantage.

Int=Integer

Composite Penalty Efficiency

$((PS)+(2*S5)*(60)+(Q5)+(2*T5)/(N5)/(60)Int*(60.6))$

N=Total power play goals scored against a team.

P=Accrued number of minutes in which a team has a one player serving penalty time.

Q=Accrued number of seconds in which a team has a one player serving penalty time.

S=Accrued number of minute in which a team has a two players serving penalty time.

T=Accrued number of seconds in which a team has a two players serving penalty time.

Int=Integer

Two Player Power Play

$$((G5*60)+(H5)/(F5)/(60)Int*(60.6))$$

F=Number of goals scored by a team when it has a two player advantage.

G=Accrued number of minutes in which a team has a two player advantage.

H=Accrued number of seconds in which a team has a two player advantage.

Int=Integer

Two Player Penalty Efficiency

$$((S5*60)+(T5)/(R5)/(60)Int*(60.6))$$

R=Number of goals scored against a team when two players are serving penalty time.

S=Accrued number of minutes in which a team has two players serving penalty time.

T=Accrued number of seconds in which a team has two players serving penalty time.

On a separate spreadsheet the major time categories are compiled. The equation is identical to two men equation.

Int=Integer

Major Power Play

$$((G5*60)+(H5)/(F5)/(60)Int*(60.6))$$

F=Number of goals scored by a team when it has a one player advantage.

G=Accrued number of minutes in which a team has a one player advantage.

H=Accrued number of seconds in which a team has a one player advantage.

Int=Integer

Major Penalty Efficiency

$$((S5*60)+(T5)/(R5)/(60)Int*(60.6))$$

R=Number of goals scored against a team when one player is serving penalty time.

S=Accrued number of minutes in which a team has one player serving penalty time.

T=Accrued number of seconds in which a team has one player serving penalty time.

The goaltenders categories are compiled on a separate spreadsheet. The three equations for the Hot Seat category are identical to composite penalty efficiency, two man penalty efficiency and major penalty efficiency.

Int=Integer

Composite Hot Seat

$$((P5)+(2S5)*(60)+(Q5)+(2*T5)/(N5)/(60)Int*(60.6))$$

N=Total power play goals scored against a goaltender.

P=Accrued number of minutes faced by a goaltender when his team has one player serving penalty time.

Q=Accrued number of seconds faced by a goaltender when his team has one player serving penalty time.

S=Accrued number of minutes faced by a goaltender when his team has two players serving penalty time.

T=Accrued number of seconds faced by a goaltender when his team has two players serving penalty time.

Int=Integer

Hot Seat Two Player Disadvantage

$$((S5*60)+(T5)/(R5)/(60)Int*(60.6))$$

R=Number of goals scored against a goaltender when two players are serving penalty time.

S=Accrued number of minutes faced by a goaltender when his team has two players serving penalty time.

T=Accrued number of seconds faced by a goaltender when his team has two players serving penalty time.

Int=Integer

Hot Seat Major Time Disadvantage

$$((S5*60)+(T5)/(R5)/(60)Int*(60.6))$$

R=Number of goals scored against a goaltender when one player is serving penalty time.

S=Accrued number of minutes faced by a goaltender when his team has one player serving penalty time.

T=Accrued number of seconds faced by a goaltender when his team has one player serving penalty time.

Int=Integer

Earned Goal Average

$$((R5)-(S5)/(Q5-T5)X(60)Int*(60.6))$$

R=Total goals against goaltender.

S=Power play goals against goaltender.

T=Total power play time faced by goaltender.

Q=Total minutes played by goaltender.

Int=Integer

*=Symbol for arithmetical function for multiplication.

/=Symbol for arithmetical function for division.

+=Symbol for arithmetical function addition.

-=Symbol for arithmetical function subtraction.

5=Denotes applicable identification column.

Procedure for Scoring

Acquire box score from newspaper as noted in the attached Appendix II illustration.

All power play, and penalty killing time is "actual time" accrued, as opposed to percentage formulation currently in use.

Power play time for Team "A" is penalty killing time for Team "B".

When Team "A" scores a power play goal in 25 seconds, they are credited 1 for 0:25 seconds of composite time.

When Team "A" is charged with a penalty while on the power play, it is charged only for accrued time while on power play.

Example: power play start at 4:10 it is charged with penalty at 4:29; Team "A" is charged 0 for 0:19 of composite time.

When Team "A" is on the power play and its opponent is charged with additional minor penalty, the two player time accrued is doubled. Example: Team "B" is charged with minor penalties at 4:10, and 5:40. Should Team "A" fail to score during this sequence, it is charged 0 for 3:00 or one-man time, 0 for 0:30 of two player time; and 0 for 4:00 of composite time.

When Team "A" has a two player advantage and scores a goal in 0:30, it is charged 1 for 1:00 of composite time, but 1 for 0:30 of two player time.

When Team "A" is on the power play and its opponent is charged with an additional minor penalty while already two players down, the third penalty time does not commence until either;

A. Team "A" scores a two player advantage goal; Example: Team "B" is charged with minor penalties at 4:10, and 4:19, when Team "B" is charged with a third minor penalty at 4:51 and Team "A" scores at 5:01, the third minor penalty time will commence at 5:01, or

B. The first penalty expires without a goal being scored by Team "A". Example: Under the circumstances described above, when the first penalty to Team "B" expired at 6:10, it is at 6:10 that the penalty time will commence to expire on the third penalty

charged to Team "B", thus, Team "A" remains on a two player advantage until the second penalty expires at 6:19. Had Team "A" fail to score at all during this sequence, the third penalty would have expired at 8:10. The power play time charged to Team "A" would be the following: 0 for 2:00 of one-player, 0 for 2:00 of two player time, 0 for 6:00 composite time.

When Team "A" has a five-minute major power play and fails to score it is charged 0 for 5:00 of major-time, and 0 for 5:00 of composite time. When Team "A" has a five-minute major power play and scores one goal it is charged 1 for 5:00 of major-time, and 1 for 5:00 of composite time.

When Team "A" has a five-minute major power play and Team "B" is charged with an additional penalty of any type, all time accrued by Team "A" is charged as two player time until there is no longer a two player advantage. Ex: Team "B" is charged with a major penalty at 5:00. At 6:30 Team "B" is charged with an additional minor penalty. Should Team "A" fail to score during this sequence the power play time accrued by Team "A" would be as follows: 0 for 3:00 of major time, 0 for 2:00 of two player time and 0 for 7:00 composite time. All power play time/penalty-killing time is charged to the goaltender who was playing goal for the defending team at that segment of the game. When a goaltending change is made the penalty-killing time is charged to the replacement goaltender thereby creating the "Hot-Seat"

compilation. The method used is the same formulation which is used for the Teams' penalty-killing ranking; two player time, major time and composite time are compiled for this category as well.

In the event that a game is played in its entirety without a power play occurring for a team/teams, no new data shall be added to the applicable category/team for that particular game.

There exists one additional goaltender characteristic, namely the "Earned Goal Average" Category. This statistic is also a derivative of power play time; in the equation given below, it will be seen, however, that the power play time and power play goals are extracted from other goaltender' statistics, i.e. total minutes played and total goals against a goaltender.

The formula given calculates even-strength goals divided by even-strength time, multiplied by sixty, (which is the length of the game), and the results are the E.G.A. statistics. For example, a very good E.G.A. would be an average of 1.50 even-strengths goals per game. A very poor average would be 4.50 even-strength goals per game. All goaltender's statistics are a by-product of teams composite statistics.

The formula for the E.G.A. reads then as follows:

$$((R4)-(S4)/(Q4-T4)/(60))$$

wherein

R equals total goals against goaltender

S equals power play goals against goaltender

Q equals total minutes played, and

T equals power play time faced

    In use the present invention is used to provide an apparatus
and method for obtaining selected performance statistics, for
example, of one or more teams engaged in competitive hockey
scores, by extensive manipulation of time frame statistics, from a
game box score, generally provided by newspapers, as shown in the
attached illustrated game box score for the Edmonton Oilers vs.
the Winnipeg Jets on Apr. 1, 1990 in Appendix II herein.
    For clarity and illustration, the aforementioned box score is
broken down in the attached chart of Appendix III herein, and
presented in chronological time frame order, showing the various
power plays and performance opportunities during the entire sixty
minutes of the three twenty minute periods of the hockey game of
Apr. 1, 1990.
    At the end of the chronological chart of the Apr. 1, 1990
hockey game, there is shown a further chart of the breakdown of

the accrued time for each power play, and by categories, such as one man time, two man time and major time.

Finally, at the end of the chronological chart of the game, there is shown the composite power play time and the power play goals scored for each respective team.

The particular chart of Apr. 1, 1990, in Appendix III herein, shows that on that date Winnipeg scored 1 power play goal over 20 minutes and 40 seconds accrued time, but Edmonton scored 2 power play goals in a much shorter time of 14 minutes and 39 seconds.

Therefore, the statistics generated by the present invention show that Edmonton performed better, because Edmonton only took an average of 7 minutes and 20 seconds for each power play goal scored in the game, whereas Winnipeg took an average of 20 minutes and 40 seconds for its single power play goal.

Thus, Edmonton is shown to be three times more efficient than Winnipeg in scoring power play goals where Edmonton has the power play advantage when one or more of the opposing Winnipeg players were serving penalty time on the penalty bench, and therefore putting Winnipeg at a disadvantage.

Likewise, the statistics shown in Appendix III herein and generated by the present invention also show Winnipeg's weakness, in its apparent inability to take advantage of the time when Edmonton was short of at least one player during a penalty time,

as well as Winnipeg's inability to score a power play goal over an extended period of time, until twenty minutes had elapsed.

BASIS FOR THE INTERMEDIATE FORMULAE IN ANOTHER PREFERRED EMBODIMENT ACCORDING TO THE INVENTION:

The aforementioned formulae are illustrative of one embodiment of the present invention. For example, the number "60.6" in the formulae includes the sum of 60 plus 0.6, which yields 60.6, to compensate for precision of certain calculators and computers for what is in actuality a factor of "60". In other calculators and/or calculators 60.5 could be used as a means for compensating for inaccuracies and precision of such calculators, for example. However, if precision is not an issue with respect to accuracy, and the calculator and/or computer is substantially 100 per cent precise and substantially 100 percent accurate, then a factor of 60 is used.

TYPICAL HOCKEY GAME

Furthermore, in a further preferred embodiment, the user may start with a typical ice hockey game as follows:

1) Game clock 0:00 - 1:24: A goal was scored by Team #2 at 1:24.

No players were serving penalty time when the goal was scored.

FORMULA #10, EARNED GOAL AVERAGE: $((R)-(S)/(Q)-(T)*(60))$

TEAM #1:

R (total goals against) 1, minus S, (power play goals against)
zero for a sum of 1. Divide by Q minus T (Q being total minutes
played by a goaltender) 1, (T being total power play time faced by
a goaltender) 0 minutes for a total of 1. The 1 goal allowed minus
the 0 power play goal divided by 1 minute equals 1.00 parts of an
earned goal per minute of even strength time. Multiply times 60,
the standard amount of time in a hockey game. The total of 60.00
is the current amount of even strength goals allowed per every 60
minutes of even strength time faced by Team #1 goaltender
identified as #31 in this game.

2) 1:24 - 2:23: A 2 minute penalty was assessed to Team #1, giving
Team #2 a power play advantage beginning at 2:23.

3) 2:23 - 5:06: A goal was scored by Team #2 at 5:06 but not
within the allotted 2 minute power play time, thus Team #2 is
charged zero power play goals for 2 minutes of 1 player and
composite power play time.

Team #1 is credited with zero power against for 2 minutes of penalty time against in 1 player and composite penalty efficiency.

FORMULA #1, COMPOSITE POWER PLAY:

$((D)+(2*G)*(60)+(E)+(2*H)/(B)/(60)INT*(60.6))$

TEAM #2:

Add D, (accrued number of minutes, in which a team has a one player advantage) D being 1 minutes, to two times G (accrued number of minutes in which a team has a has a two player advantage) G being 0 times 2, added to 2 equals 2. Multiply this sum 8 by 60, thereby transposing all player advantage minutes into 120 seconds. Add the sum of 120 seconds to E, accrued number of seconds in which a team has a one player advantage) E being 0 seconds, total 120 seconds, then add again to two times H (accrued number of seconds in which a team has a two player advantage) 0 seconds times two equals 0 seconds, total is 120 seconds. Divide 120 seconds by B (total power play goals scored by a team) B being 1, the sum is 594. When B equals zero no average can be acquired and all time accrues. When B equals 1 divide again by 60 thereby

transposing the seconds into minutes. The sum is 9.9. Whereby the

2. represents whole total minutes and the fraction represents the

integer, .9. The integer is multiplied by 60.6, the integer

calculation producing the whole number 0. The integer being

located the right of the whole number 2 would display in the

following manner: 2:00 being TEAM #2 power play efficiency at this

time of the game.

FORMULA #2, COMPOSITE PENALTY EFFICIENCY:

$((P)+(2*S)*(60)+(Q)+(2*T)/(N)/(60)INT*(60.6))$

TEAM #2:

Add P, (accrued number of minutes, in which a team has one player

serving penalty time) P being 2 minutes, to two times S (accrued

number of minutes in which a team has two players serving penalty

time) S being 0 times 0, added to 2 equals 2. Multiply this sum 2

by 60, thereby transposing all penalty minutes into 120 seconds.

Add the sum of 120 seconds to Q, accrued number of seconds in

which a team has one player serving penalty time) Q being 0

seconds, total 120. Add to two times T (accrued number of seconds

in which a team has two players serving penalty time) T being 0

seconds times two equals 0 seconds the total is 120 seconds.
Divide 120 seconds by N (total power play goals scored against a
team) N being 0. When N equals 0 no average can be acquired and
all penalty time accrues. When N equals 1 divide by 60 thereby
transposing the seconds into minutes. The sum is 2.00 whereby the
2 represents whole total minutes and the fraction represents the
integer, .00. The integer is multiplied by 60.6, the integer
calculation producing the whole number 50. The integer being
located the right of the whole number 2 would display in the
following manner: 2:00 being TEAM #2 penalty efficiency at this
time of the game.

FORMULA #7, COMPOSITE HOT SEAT:

$((P)+(2*S)*(60)+(Q)+(2*T)/(N)/(60)INT*(60.6))$

TEAM #1:

Add P, (accrued number of minutes, in which a team has one player
serving penalty time) P being 2 minutes, to two times S (accrued
number of minutes in which a team has two players serving penalty
time) S being 0 times 0, added to 2 equals 2. Multiply this sum 2
by 60, thereby transposing all penalty minutes into 120 seconds.

Add the sum of 120 seconds to Q, accrued number of seconds in which a team has one player serving penalty time) Q being 0 seconds, total 120. Add to two times T (accrued number of seconds in which a team has two players serving penalty time) T being 0 seconds times two equals 0 seconds the total is 120 seconds. Divide 120 seconds by N (total power play goals scored against a team) N being 0. When N equals 0 no average can be acquired and all penalty time accrues. When N equals 1 divide by 60 thereby transposing the seconds into minutes. The sum is 2.00 whereby the 2 represents whole total minutes and the fraction represents the integer, .00. The integer is multiplied by 60.6, the integer calculation producing the whole number 50. The integer being located the right of the whole number 2 would display in the following manner: 2:00 being TEAM #2 Composite Hot Seat at this time of the game.

4) 5:06 - 5:39: At 5:39 a 2 minute penalty was assessed to Team #2, thus giving Team #1 a power play beginning at 5:39.

5) 5:39 - 11:56: A 2 minute penalty was assessed to Team #1 at 11:56

Team #1 did not score a power play goal within the allotted 2 minute power play time that started at 5:39. Team #1 is charged

zero power play goals for 2 minutes of 1 player and composite power play time. Team #2 is credited with zero goals against for 2 minutes of 1 player and composite penalty time against. Penalty to Team #1 begins at 11:56.

6) 11:56 - 14:27: A 2 minute penalty was assessed to Team #2 at 14:27 giving Team #1 a power play. Team #2 did not score a power play goal within the allotted 2 minute power play time that started at 11:56. Team #2 is charged zero power play goals for 2 minutes of 1 player and composite power play time. Team #1 is credited with zero goals against for 2 minutes of 1 player and composite penalty time against. Penalty to Team #1 begins at 14:27.

7) 14:27 - 15:08: A goal was scored by Team #2 at 15:08. Team #1 power play is charged zero power play goals for 41 seconds of 1 player and composite power play time. Team #2 is credited with zero goals and 41 seconds of 1 player and composite penalty efficiency time.

8) 15:08 - 16:05: A 2 minute penalty was assessed at 16:05 against Team #2 when 1 player was already serving penalty time. Team #1 is charged zero goals and 57 seconds in 1 player and composite power play time. Team #2 is charged zero goals and 57 seconds in 1

player and composite power play time against. A two player

advantage for 22 seconds begins at 16:05 for Team #1.

9) 16:05 - 17:25: A 2 minute penalty was assessed to Team #1

during a power play. Team #1 expired the 22 seconds of two player

advantage at 16:27 without scoring and continued on a 1 player

advantage from 16:27 to 17:25 for an additional 58 seconds of 1

player power play time. Team #1 is charged zero power play goals

for 22 seconds of 2 player advantage time, zero goals for 58

seconds of 1 player advantage time and zero goals for 1 minute and

42 seconds of composite power play time. Team #2 is credited with

zero for 22 seconds of 2 player power play time against, zero

goals for 58 seconds of 1 player advantage and zero goals for 1

minute and 42 seconds of composite penalty efficiency. When play

resumed at 17:25 both teams had 1 player serving penalty time.

FORMULA #3, TWO PLAYER POWER PLAY:

$((G)*(60)+(H)/(F)/(60)INT*(60.6))$

TEAM #1:

Multiply times 60 G (accrued number of minutes in which a team has a two player advantage) 0. Add to H (accrued number of seconds in which a team has a two player advantage) 22. Total is 22 seconds. Divide by F (number of goals scored by a team when it has a two player advantage) 0. When F equals 0 indicating no two player power play goals scored for in any team no average can be acquired and all time accrues. When F equals 1 divide by 60 and multiply the integer by 60.6. The integer being located the right of the whole number 0 would display in the following manner: 0:22 being TEAM #1 two player power play for this game.

FORMULA #8, HOT SEAT TWO PLAYER PENALTY DISADVANTAGE:

$((S)*(60)+(T)/(R)/(60)INT*(60.6))$

TEAM #2

Multiply times 60 S (accrued number of minutes in which a team has two players serving penalty time) S being 0 time 60 equals 0 seconds. Add to T (accrued number of seconds in which a team has two players serving penalty time. T being 22, total seconds is 22. Divide by R (number of goals scored against a team when two players are serving penalty time, R being 0. When R equals 0

indicating no two player power play goals scored against a goaltender no average can be acquired and all time accrues. When R equals 1 divide by 60, multiply the integer by 60.6. It would display in the following manner: 0:22 being TEAM #2 goaltender Hot Seat two player penalty efficiency for this game.

10) 17:25 - 20:00: The period ended at 20:00. At 18:05 Team #2 penalty expired. Team #2 had a 1 player advantage power play 18:05 to 19:25 and did not score a goal. Team #2 is charged zero goals for 1 minute and 20 seconds of 1 player power play. Team #1 was credited with zero goals for 1 minute and 20 seconds of penalty efficiency. End #1.

PERIOD #2

1) Game clock 0:00 to 1:01: A 2 minute penalty was assessed to Team #2, giving Team #1 a power play advantage beginning at 1:01.

2) 1:01 - 4:57: A 2 minute penalty was assessed to Team #1 and

Team #2. No power play advantage. Team #1 did not score a power play goal within the allotted 2 minute power play time that

started at 1:01. Team #1 is charged zero power play goals for two minutes of 1 player and composite power play time. Team #2 is credited with zero goals against and two minutes of 1 player and composite penalty time against.

3) 4:57 - 5:26: A goal is scored by Team #2. No players were serving penalty time when the goal was scored.

4) 5:26 - 6:38: A goal is scored by Team #1. No players were serving penalty time when the goal was scored.

5) 6:38 - 8:03: A 2 minute penalty was assessed to Team #1 giving Team #2 a power play advantage beginning at 8:03.

6) 8:03 - 8:33: A 2 minute penalty is assessed to Team #2 thereby nullifying their power play advantage that began at 8:03. Team #2 is charged zero power play goals for 30 seconds of 1 player and composite power play time. Team #1 is credited with zero goals against for 30 seconds of 1 player and composite penalty efficiency time against. Team #2 power play will begin at 10:03. Both teams now have 1 player serving penalty time. (A delayed power play will begin for Team #1 at 10:03.

7) 8:33 - 12:12: A 2 minute penalty was assessed to Team #1 and Team #2. No power play advantage. Team #1 did not score a power play goal during a power play that began at 10:03. Team #1 is charged zero power play goals for 30 seconds of 1 player and composite power play time. Team #2 is credited with zero goals against and 30 seconds of 1 player and composite penalty time against.

8) 12:12 - 13:15: A 2 minute penalty is assessed to Team #2 giving Team #1 a power play advantage beginning at 13:15.

9) 13:15 - 19:13: A 2 minute penalty is assessed to Team #1 giving Team #2 a power play advantage beginning at 19:13. Team #1 did not score a power play goal within the allotted 2 minute power play time that started at 13:15. Team #1 is charged zero power play goals for two minutes of 1 player and composite power play time. Team #2 is credited with zero goals against and 2 minutes of 1 player and composite penalty time against. Penalty to Team #1 begins at 19:13.

10) 19:13 - 19:17: Team #2 scores a goal a 19:17 during a 1 player power play advantage. Team #2 is credited with 1 power play goal for 4 seconds of 1 player and composite power play time. Team #1

is charged 1 power play goal against for 4 seconds of 1 player and composite penalty efficiency time against.

11) 19:17 - 20:00: Time expired with no penalties or goals scored. End #2

☐PERIOD #3

1) 0:00 - 0:13: A 2 minute penalty was assessed to Team #1 giving Team #2 a power play advantage beginning at 0:13.

2) 0:13 - 0:30: A 2 minute penalty was assessed to Team #1 giving Team #2 a 2 player power play advantage beginning at 0:30. Team #2 is charged zero goals for 17 seconds of 1 player and composite power play time. Team #1 is credited zero goals against for 17 seconds of 1 player and composite penalty efficiency time.

3) 0:30 - 3:11: Team #1 is assessed a 5 minute major penalty. Team #1 did not score a goal during a 2 player power play advantage that began at 0:30 and ended at 2:13, 1 minute and 43 seconds. Team #2 also did not score during the remainder of a 1 player power play advantage from 2:13 through 2:30, 17 seconds. Team #2

is charged zero goals for 1 minute and 43 seconds of 2 player

power play advantage time, zero goals for 17 seconds of 1 player

advantage time and zero goals for 3 minutes and 45 seconds of

composite power play time. Team #1 is charged zero goals against

for 1 minute and 43 seconds of 2 player penalty efficiency time,

zero goals for 17 seconds of 1 player penalty efficiency time and

zero goals for 3 minutes and 45 seconds of composite penalty

efficiency time against. A 5 minute major power play begins for

Team #1 at 3:11.

FORMULA #4, TWO PLAYER PENALTY EFFICIENCY:

$((S)*(60)+(T)/(R)/(60)INT*(60.6))$

TEAM #1:

Multiply times 60 S (accrued number of minutes in which a team has

two players serving penalty time) S being 1 time 60 equals 60

seconds. Add to T (accrued number of seconds in which a team has

two players serving penalty time. T being 43, total seconds is

103. Divide by R (number of goals scored against a team when two

players are serving penalty time, R being 0. When R equals 0

indicating no two player power play goals scored against no

average can be acquired and all time accrues. When R equals 1

divide by 60, multiply the integer by 60.6. The integer being

located to the right of the whole number would display in the

following manner: 1:43 being Team #1 two player penalty efficiency

for this game.

4) 3:11 - 11:35: A 2 minute penalty was assessed to Team #1 at

11:35 giving Team #2 a power play. Team #1 did not score a goal

within the allotted 5 minutes of major play time that started at

3:11. Team #1 is charged zero goals for 5 minutes of 1 player, 5

minutes of major power play time and 5 minutes of composite power

play time. Team #2 is credited with zero goals against for 5

minutes of 1 player, 5 minutes of major power play time and 5

minutes of composite penalty time against. Penalty to Team #1

begins at 11:35.

FORMULA #5, MAJOR POWER PLAY: $((G)*(60)+(H)/(F)/(60)INT*(60.6))$

TEAM #1:

Multiply times 60 G (accrued number of minutes in which a team has

a major player advantage) G being 5 for a total of 300 seconds.

Add to H (accrued number of seconds in which a team has a major

power play) H being 0 for a total of 300 seconds. Divide by F

(number of goals scored by a team when it has a one player

advantage) 0. When F equals 0 indicating no major power play goals

scored, no average can be acquired and all time accrues. When F

equals 1 divide by 60, multiply the integer by 60.6. The integer

being located the right of the whole number 5 would display in the

following manner: 5:00 being TEAM #1 major power play for this

game.

FORMULA #6, MAJOR PENALTY EFFICIENCY:

$((S)*(60)+(T)/(R)/(60)INT*(60.6))$

TEAM #2:

Multiply times 60 S (accrued number of minutes in which a team has

a major penalty) S being 5 for a total of 300 seconds. Add to T

(accrued number of seconds in which a team has a major penalty) T

being 0 for a total of 300 seconds. Divide by R (number of goals

allowed by a team when it has a major penalty) 0. When R equals 0

indicating no major power play goals allowed by any team no

average can be acquired and all time accrues. When R equals 1

divide by 60, multiply the integer by 60.6.

FORMULA #9, HOT SEAT MAJOR TIME EFFICIENCY:

((S)*(60)+(T)/(R)/(60)INT*(60.6))

TEAM #2:

Multiply times 60 S (accrued number of minutes in which a team has

a major penalty) S being 5 for a total of 300 seconds. Add to T

(accrued number of seconds in which a team has a major penalty) T

being 0 for a total of 300 seconds. Divide by R (number of goals

allowed by a team when it has a major penalty) 0. When F equals 0

indicating no major power play goals allowed by any team no

average can be acquired and all time accrues. When F equals 1

divide by 60, multiply the integer 60.6. The integer being located

the right of the whole number 5 would display in the following

manner: 5:00 being TEAM #2 goaltender Hot Seat Major Time

Efficiency for this game.

5)11:35 - 20:00: The game clock expired. Team #2 did not score a

goal during a 2 minute power play 11:35 through 13:35. Team #2 is

charged zero goals scored, for 2 minutes of 1 player advantage and composite power play time. Team #1 is credited with zero goals against for 2 minutes of 1 player and composite penalty efficiency time. End #3

OVERTIME--None

CALCULATIONS FOR THE TYPICAL HOCKEY GAME

    Under the preferred embodiment, the calculations for the above typical hockey game are as follows:

FORMULA #1, COMPOSITE POWER PLAY:

$((D)+(2*G)*(60)+(E)+(2*H)/(B)/(60)INT*(60.6))$

TEAM #2:

Add D, (accrued number of minutes, in which a team has a one player advantage) D being 6 minutes, to two times G (accrued number of minutes in which a team has a has a two player advantage) G being 1 times 2, added to 6 equals 8. Multiply this

sum 8 by 60, thereby transposing all player advantage minutes into
480 seconds. Add the sum of 480 seconds to E, accrued number of
seconds in which a team has a one player advantage) E being 28
seconds, total 508 seconds, then add again to two times H (accrued
number of seconds in which a team has a two player advantage) 43
seconds times two equals 86 seconds, total is now 594 seconds.
Divide 594 seconds by B (total power play goals scored by a team)
B being 1, the sum is 594. When B equals zero no average can be
acquired and all time accrues. When B equals 1 divide again by 60
thereby transposing the seconds into minutes. The sum is 9.9.
Whereby the 9. represents whole total minutes and the fraction
represents the integer, .9. The integer is multiplied by 60.6, the
integer calculation producing the whole number 54. The integer
being located the right of the whole number 9 would display in the
following manner: 9:54 being TEAM #2 power play efficiency for
this game.

FORMULA #2, COMPOSITE PENALTY EFFICIENCY:

$((P)+(2*S)*(60)+(Q)+(2*T)/(N)/(60)INT*(60.6))$

TEAM #2:

Add P, (accrued number of minutes, in which a team has one player serving penalty time) P being 14 minutes, to two times S (accrued number of minutes in which a team has two players serving penalty time) S being 2 times 0, added to 14 equals 14. Multiply this sum 14 by 60, thereby transposing all penalty minutes into 840 seconds. Add the sum of 840 seconds to Q, accrued number of seconds in which a team has one player serving penalty time) Q being 6 seconds, total 846. Add to two times T (accrued number of seconds in which a team has two players serving penalty time) T being 22 seconds times two equals 44 seconds. the total is 890 seconds. Divide 890 seconds by N (total power play goals scored against a team) N being 0. When N equals 0 no average can be acquired and all penalty time accrues. When N equals 1 divide by 60 thereby transposing the seconds into minutes. The sum is 14.83 whereby the 14. represents whole total minutes and the fraction represents the integer, .83 the integer is multiplied by 60.6, the integer calculation producing the whole number 50. The integer being located the right of the whole number 14 would display in the following manner: 14:50 being TEAM #2 penalty efficiency for this game.

FORMULA #3, TWO PLAYER POWER PLAY:

$((G)*(60)+(H)/(F)/(60)INT*(60.6))$

TEAM #1:

Multiply times 60 G (accrued number of minutes in which a team has a two player advantage) 0. Add to H (accrued number of seconds in which a team has a two player advantage) 22. Total is 22 seconds. Divide by F (number of goals scored by a team when it has a two player advantage) 0. When F equals 0 indicating no two player power play goals scored for in any team no average can be acquired and all time accrues. When F equals 1 divide by 60 and multiply the integer by 60.6. The integer being located the right of the whole number 0 would display in the following manner: 0:22 being TEAM #1 two player power play for this game.

FORMULA #4, TWO PLAYER PENALTY EFFICIENCY:

$((S)*(60)+(T)/(R)/(60)INT*(60.6))$

TEAM #1:

Multiply times 60 S (accrued number of minutes in which a team has two players serving penalty time) S being 1 time 60 equals 60 seconds. Add to T (accrued number of seconds in which a team has two players serving penalty time. T being 43, total seconds is 103. Divide by R (number of goals scored against a team when two players are serving penalty time, R being 0. When R equals 0 indicating no two player power play goals scored against no average can be acquired and all time accrues. When R equals 1 divide by 60, multiply the integer by 60.6. The integer being located to the right of the whole number would display in the following manner: 1:43 being Team #1 two player penalty efficiency for this game.

FORMULA #5, MAJOR POWER PLAY: $((G)*(60)+(H)/(F)/(60)INT*(60.6))$

TEAM #1:

Multiply times 60 G (accrued number of minutes in which a team has a major player advantage) G being 5 for a total of 300 seconds. Add to H (accrued number of seconds in which a team has a major power play) H being 0 for a total of 300 seconds. Divide by F (number of goals scored by a team when it has a one player

advantage) 0. When F equals 0 indicating no major power play goals scored, no average can be acquired and all time accrues. When F equals 1 divide by 60, multiply the integer by 60.6. The integer being located the right of the whole number 5 would display in the following manner: 5:00 being TEAM #1 major power play for this game.

FORMULA #6, MAJOR PENALTY EFFICIENCY:

$$((S)*(60)+(T)/(R)/(60)INT*(60.6))$$

TEAM #2:

Multiply times 60 S (accrued number of minutes in which a team has a major penalty) S being 5 for a total of 300 seconds. Add to T (accrued number of seconds in which a team has a major penalty) T being 0 for a total of 300 seconds. Divide by R (number of goals allowed by a team when it has a major penalty) 0. When R equals 0 indicating no major power play goals allowed by any team no average can be acquired and all time accrues. When R equals 1 divide by 60, multiply the integer by 60.6.

GOALTENDER STATISTICS:

All goaltender statistics are determined according appearance /
time-in time-out during the course of events.

FORMULA #7, COMPOSITE HOT SEAT:

$((P)+(2*S)*(60)+(Q)+(2*T)/(N)/(60)INT*(60.6))$

TEAM #2:

Add P, (accrued number of minutes, in which a team has one player
serving penalty time) P being 14 minutes, to two times S (accrued
number of minutes in which a team has two players serving penalty
time) S being 2 times 0, added to 14 equals 14. Multiply this sum
14 by 60, thereby transposing all penalty minutes into 840
seconds. Add the sum of 840 seconds to Q, accrued number of
seconds in which a team has one player serving penalty time) Q
being 6 seconds, total 846. Add to two times T (accrued number of
seconds in which a team has two players serving penalty time) T

being 22 seconds times two equals 44 seconds. the total is 890

seconds. Divide 890 seconds by N (total power play goals scored

against a team) N being 0. When N equals 0 indicating no power

play goals scored against a goaltender no average can be acquired

and all time accrues. When N equals 1 divide by 60 thereby

transposing the seconds into minutes. The sum is 14.83 whereby the

14. represents whole total minutes and the fraction represents the

integer, .83 the integer is multiplied by 60.6, the integer

calculation producing the whole number 50. The integer being

located the right of the whole number 14 would display in the

following manner: 14:50 being TEAM #2 Hot Seat efficiency for this

game.

FORMULA #8, HOT SEAT TWO PLAYER PENALTY DISADVANTAGE:

$((S)*(60)+(T)/(R)/(60)INT*(60.6))$

TEAM #2

Multiply times 60 S (accrued number of minutes in which a team has

two players serving penalty time) S being 0 time 60 equals 0

seconds. Add to T (accrued number of seconds in which a team has

two players serving penalty time. T being 22, total seconds is 22.

Divide by R (number of goals scored against a team when two

players are serving penalty time, R being 0. When R equals 0

indicating no two player power play goals scored against a

goaltender no average can be acquired and all time accrues. When R

equals 1 divide by 60, multiply the integer by 60.6. It would

display in the following manner: 0:22 being TEAM #2 goaltender Hot

Seat two player penalty efficiency for this game.

FORMULA #9, HOT SEAT MAJOR TIME EFFICIENCY:

$((S)*(60)+(T)/(R)/(60)INT*(60.6))$

TEAM #2:

Multiply times 60 S (accrued number of minutes in which a team has

a major penalty) S being 5 for a total of 300 seconds. Add to T

(accrued number of seconds in which a team has a major penalty) T

being 0 for a total of 300 seconds. Divide by R (number of goals

allowed by a team when it has a major penalty) 0. When F equals 0

indicating no major power play goals allowed by any team no

average can be acquired and all time accrues. When F equals 1

divide by 60, multiply the integer 60.6. The integer being located

the right of the whole number 5 would display in the following

manner: 5:00 being TEAM #2 goaltender Hot Seat Major Time

Efficiency for this game.

FORMULA #10, EARNED GOAL AVERAGE: ((R)-(S)/(Q)-(T)*(60))

TEAM #1:

R (total goals against) 5, minus S (power play goals against) for

a sum of 4. Divide by Q minus T (Q being total minutes played by a

goaltender) 40, (T being total power play time faced by a

goaltender) 6 minutes for a total of 34. The 5 goals allowed minus

the 1 power play goal divided by 34 minutes equal 0.11 parts of an

earned goal per minute of even strength time. Multiply times 60,

the standard amount of time in a hockey game. The total of 7.05 is

the average amount of even strength goals allowed per every 60

minutes of even strength time faced by Team #1 goaltender

identified as #31 in this game.

DEFINITIONS

The definitions applicable to the above calculations are as follows:

☐PRD#: PERIOD OF PLAY

TEAM PP#: POWER PLAY OPPORTUNITY BY TEAM NUMBER

IN: ELAPSED GAME CLOCK TIME-IN

OUT: ELAPSED GAME CLOCK TIME-OUT

PPTB: POWER PLAY TIME BEGIN

MLTH: MAXIMUM LENGTH POWER PLAY TIME IN MINUTES

PA: PLAYER ADVANTAGE: 1 PLAYER/2 PLAYER/MAJOR TIME

TGS: ELAPSED TIME GAME CLOCK ALL GOALS SCORED

PEN: ELAPSED TIME GAME CLOCK ALL PENALTIES

OPP GLTNDR: OPPOSING GOALTENDER

OG: OPPOSING GOALTENDER SWEATER NUMBER

MP: TEAMS OPPOSING GOALTENDER ELAPSED TIME MINUTES PLAYED BETWEEN

TIME-IN TIME-OUT (ROUNDED OUT TO NEAREST MINUTE PER 30 SECONDS OF

PLAYING TIME)

GA: OPPOSING GOALTENDER TOTAL GOALS AGAINST

1-PLAYER: 1-PLAYER POWER PLAY ADVANTAGE

G: 1-PLAYER POWER PLAY GOALS SCORED

M: 1-PLAYER POWER PLAY MINUTES

S: 1-PLAYER POWER PLAY SECONDS

2-PLAYER 2-PLAYER POWER PLAY ADVANTAGE

G: 2-PLAYER POWER PLAY GOALS SCORED

M: 2-PLAYER POWER PLAY MINUTES

S: 2-PLAYER POWER PLAY SECONDS

MAJOR: MAJOR POWER PLAY ADVANTAGE

G: MAJOR TIME POWER PLAY GOALS SCORED

M: MAJOR TIME POWER PLAY MINUTES

S: MAJOR TIME POWER PLAY SECONDS

COMPOSITE: COMPOSITE POWER PLAY ADVANTAGE

G: COMPOSITE POWER PLAY GOALS SCORED

M: COMPOSITE POWER PLAY MINUTES

S: COMPOSITE POWER PLAY SECONDS

RUNNING TIME: SUB TOTAL OF POWER PLAY GOALS/POWER PLAY TIME

CREDITED TO A TEAM

BY TIME-IN / TIME-OUT OF GAME.

1-PLAYER: 1-PLAYER POWER PLAY ADVANTAGE

G: 1-PLAYER POWER PLAY GOALS SCORED

M: 1-PLAYER POWER PLAY MINUTES

S: 1-PLAYER POWER PLAY SECONDS

2-PLAYER 2-PLAYER POWER PLAY ADVANTAGE

G: 2-PLAYER POWER PLAY GOALS SCORED

M: 2-PLAYER POWER PLAY MINUTES

S: 2-PLAYER POWER PLAY SECONDS

MAJOR: MAJOR POWER PLAY ADVANTAGE

G: MAJOR TIME POWER PLAY GOALS SCORED

M: MAJOR TIME POWER PLAY MINUTES

S: MAJOR TIME POWER PLAY SECONDS

COMPOSITE: COMPOSITE POWER PLAY ADVANTAGE

G: COMPOSITE POWER PLAY GOALS SCORED

M: COMPOSITE POWER PLAY MINUTES

S: COMPOSITE POWER PLAY SECONDS

OPPOSING GOALTENDER: OPPOSING TEAMS GOALTENDER APPEARING IN GAME AT TIME OF EVENT

*****

SUMMARY OF THE INVENTION

Specifically, in a converting device for converting a box score in a hockey game eventually to final statistics relating to composite power play, composite penalty efficiency, two-player power-play, two-player penalty efficiency, major power play, major penalty efficiency, composite hot seat, hot seat two-player disadvantage, hot seat major disadvantage, and earned goal average, and wherein the final statistics are, in turn, obtainable from intermediate statistical data, an improvement will be described hereinbelow.

In that improvement the intermediate statistical data are identified by a combination of respective letters and/or numbers, and are fed into a standard calculator or computer so as to obtain the final statistics therefrom. The improvement is best understood with reference to a description, appearing herein-below, to be read in conjunction with the illustration of the accompanying figs. It is advantageous if a longitudinal carriage is provided, and if converting means are used to obtain intermediate statistical data from the box score, and the converting means include a longitudinal timing chart disposed in parallel with a first axis, calibrated along its ordinate sequentially at predetermined major intervals, while along its abscissa and parallel to a second axis perpendicular to the first axis there are denoted generally a first team, followed sequentially by a second team which normally opposes the first team.

Additionally it is advantageous if tape holding means defining a center axis are used. The center axis can be positioned in parallel with the second axis, and tape holding means are preferably adapted for carrying a plurality of at least three tape reels with respective differently identified tapes.

Advantageously tape unrolling means are provided for unrolling at least one of the tapes from the tape holding means, and tape dispensing means are preferably used for dispensing the

at least one of the tapes; additionally tape dispensing control means are preferably employed for controlling the tape dispensing means.

Advantageously mobile length measuring means can operably be moved in a forward direction within 180 degrees along generally arbitrary moving directions from a starting position to an end position, for measuring a predetermined length of at least the one of the tapes, so as to substantially be independent of the movement-direction, and thus become substantially movement-direction independent.

This is so, provided that a path taken by the mobile length measuring means between the above-noted positions does not have a component in any direction opposite to the forward direction.

It is additionally preferable if conversion means are used for changing the mobile length measuring means to stationary length measuring means with respect to the carriage, and if marking means on the tape dispensing means are used for marking chosen or other parameters on the timing chart. The tape selection means are preferably spaced apart from, opposite to, and cooperating with the tape holding means for selecting one of the tapes, and the tape restraining means are preferably used for restraining the one of the tapes to follow a predetermined path.

It is advantageous if cutting means are employed for cutting off the predetermined length of the one of the tapes from the

dispensing means, and if adhesive means are employed for laying down and adhering the predetermined length of the one of the tapes onto, and to the timing chart, respectively, so as to extend in parallel with the first axis.

Additionally, it is preferable if engagement means are employed between the timing chart, and the tape unrolling means, and if translatory moving means are used for automatically moving the carriage in a direction parallel to the first axis and relative to the timing chart along translation direction between an initial position denoting zero tape travel, and a second position away from the initial position, so as to denote distance traveled from the initial position.

Preferably at least the tape dispensing means, the control means, the stationary length measuring means, the marking means, the tape selection means, the tape unrolling means, the tape restraining means, and the cutting means are contained in the carriage, so that the carriage can be manually moved in a direction parallel to the second axis, and so as to obtain a selected position of the carriage with respect to the timing chart.

The converting means preferably use differently marked tapes with different respective colors.

The tape unrolling means preferably comprise an electric motor rotatably attached to the carriage, and define at least one

motor axis substantially parallel with the second axis, at least one of the tape reels can be coupled to the motor, and tape guiding means are provided to guide the one of the tapes along a predetermined path within the carriage.

The cutting means comprises preferably blade guiding means secured to the carriage, so that the blade normally passes through the blade guiding means, and wherein a wedge is formed in one longitudinal side of the carriage, and an exit slot is defined between the wedge and a remaining part of the one longitudinal side, and wherein blade guiding means are located above the exit slot, so that the at least one of the tapes can be passed over the gap on being unrolled, whereby the predetermined length is cut off from the one tape upon the blade passing over the exit slot, when actuated by the length measuring means.

The adhesive means preferably include two sets of ridges spaced apart from one another on each side of the one of the tapes, respectively, so as to be equivalent to respective seconds in time, and the timing chart preferably includes ridges on a front surface thereof spaced from one another, and cooperating with corresponding ridges on the one of the tapes, so that the cooperating ridges operatively mate with one another.

The converting means preferably further comprise a mounting and alignment frame, which can be aliened with the timing chart in discrete steps, and where each of the steps corresponds to an

interval of one minute, and includes a rail parallel to the second axis, wherein the second axis is substantially horizontal, and a first travel frame is arranged in the mounting and alignment frame, and has a longitudinal base provided with a bore, so that the rail can be passed therethrough, and so that the first travel frame is slidable along the rail in a direction parallel to the second axis.

The longitudinal base of the first travel frame preferably includes two outside arms extending in parallel opposite one another, and in a direction away from the longitudinal base, and at right angles thereto, and preferably further includes a second travel frame nestled between the outside arms, which is slidable therebetween in a direction substantially parallel to the first axis. It is advantageous if the second travel frame includes the tape dispensing control means in the form of a numeric key pad provided with at least ten actuating keys, at least a four digit display, and a plurality of function buttons providing at least for offset-, length-, reset-, and start-modes.

The tape selection means preferably comprise manually actuatable guide means for selecting the one of the tapes, and drive wheels for moving the carriage forwardly or rearwardly. The tape holding means are advantageously provided with a reel holder mounted on the carriage, and being adapted to hold a plurality of tape supply reels, and wherein the guide means substantially

define a first plane, and include a U-shaped bracket having arms
extending therefrom in parallel with, and opposite to one another,
and formed with horizontally aligned openings, respectively.

It is further advantageous if a manually operable reel-
selector bar extending substantially at right angles to the plane
of normally actuatable guide means extending from an interior of
the carriage is provided, and wherein the side opposite to the one
side is formed with a longitudinal guide slot, and with a
plurality of reel-identifying indents communicating with the
horizontal guide slot, and extending at right angles thereto, and
wherein the plurality of indents correspond to a plurality of
respective tape-carrying reels, and the longitudinal guide slot
extends in a direction parallel to the second axis. Advantageously
a tape-moving or reel selection shaft, or reel-coupling means
carrying shaft is provided which has a polygonal cross-section on
a center portion thereof, and fits into the openings of the two
arms of the guide means, respectively, and carries reel-coupling
means slidably connected to the reel-selection shaft along an axis
thereof parallel to the second axis for positioning the reel-
coupling means along an axis thereof opposite a selected one of
the reels,

whereby the selected one of the one of the tapes is
automatically movable in a direction parallel to the first axis,
until the one of the tapes reaches the tape exit slot formed in

the carriage, and thereafter is movable by the control means, until the predetermined length of offset is reached, and is adhesively superimposable by means of the cooperating and mating ridges onto the timing chart at a desired location of the one of the tapes.

The carriage preferably comprises first and second axles or shafts coaxial with the tape-moving shaft, and the shaft of the drive wheels, respectively, and solenoid-actuatable first and second clutch brake assemblies are preferably coaxial with the tape moving shaft, and the shaft of the drive wheels, respectively.

The plurality of tapes preferably includes four tapes, and wherein the polygonal cross-section is preferably a square cross-section which has four sides corresponding to the four tapes, respectively.

The one side of the carriage preferably comprises a floor, and wherein the tape restraining means preferably comprises an elastomeric pressure pad generally juxtaposed with a portion of the floor, and part of the exit gap, and the one of the tapes can be passed through the exit slot.

The length measuring means preferably has a generally longitudinal shape, and preferably includes a piezo-electric or magnetic transducer having an input, a pulse shaper having an input for accepting an input of the transducer, a counter having

forward or backward switchable modes, and having a first input for accepting the output of the transducer, a second input thereof being connected to a groundable reset switch for resetting the counter to zero, a binary-to-digital converter accepting on an input thereof the output of the counter, and displaying the latter-named output, and means for actuating the cutting means upon the counter, operating in the backward mode, having reached the predetermined count. It is advantageous, if the length measuring means had a longitudinal shape, and is provided with at least two guide-posts on an input end thereof, and wherein the one side of the carriage formed with the exit slot includes a fixed-location transducer having an output end of a stylus connected with an input thereof, and the stylus is in operative contact with the ridges of the timing chart, the fixed-length transducer being additionally formed on an output end thereof with two recesses mating with respective of the latter-named guide-posts for being snapped thereinto, and wherein the length measuring device is formed with an input for accepting an output of the fixed-location transducer, whereby, upon the output of the fixed location transducer being connected to the input of the truncated length-measuring means, and upon the guide-posts being snapped into respective of the recesses, the longitudinal shape becomes connected to, and rigid with the carriage of the converting device, so that the mobile length measuring means becomes a fixed-

location length measurement means with respect to the carriage. The moving means preferably comprise an actuatable electric motor provided with a pulley, and rotatably secured to the carriage, and belt-and/or chain means engageable with the motor, and with the first and second shafts, respectively.

The carriage is advantageously provided with actuatable brake and clutch means selectively acting as brake or clutch, respectively, whereby each of the brake and clutch means can be actuatated to be positively coupled to each of the axles, respectively, or be free-wheeling.

The carriage further advantageously comprises a drive solenoid having a housing, a plunder substantially resting in the housing, but having one end thereof disposed outside of the housing, a restraining spring extending between the housing and the other end of the plunger, ball-joint coupling having one end joined to the one end of the plunger, a splined shaft joined to the other end of the plunger, a substantially cylindrical housing rigid with the drive solenoid, and having an end friction surface thereof facing away from the solenoid, a brake/clutch disk having a splined bore, so as to be slidable on the splined shaft, each lateral side of the brake/clutch disk having a clutch-friction surface, a timing-belt pulley having a friction surface facing one of the friction surfaces of the brake/clutch disk, and having an outwardly extending driving shaft attached thereto, whereby, on

the solenoid being energized, the friction surface of the pulley engages the one friction surface of the brake/clutch disk, so as to be coupled thereto, so that the driving shaft is drivable, while, on the solenoid becoming de-energized, the restraining spring retracts the plunger, so that the other friction of the brake/clutch disk is coupled to the end friction surface of the housing, and that the pulley and its driving shaft become free-wheeling.

It is further advantageous if a length measurement means is provided with a piezo-electric or magnetic transducer having an input, a pulse shaper having an input for accepting the output of the transducer, a counter having forward or backward switchable modes, and having a first input for accepting the output of the transducer, a groundable reset switch for resetting the counter to zero being connected to a second input of said counter, a binary-to-digital converter accepting on an input thereof the output of the counter, and display means for viewing an output of the converter.

In the preferred embodiment of the invention, an apparatus for determining performance -indicating numbers in sports games, particularly in ice hockey, includes a database having sports games box scores stored therein. The database is stored in a tangible electronic media, such as magnetic media, optical media, electronic media, paper, thermosetting polymers, rubber, metals,

or other suitable storage media. Such media includes computer diskettes, magnetic tape, optical disks, random access memory, read only memory, computer punch cards, and other volatile, temporary, and/or permanent memory devices. The database scores box scores, such as start time, stop time, team 1 goals and time of goals, team 1 goalies A and B goals and power plays, and team 2 goalies A and B goals and power plays.

The apparatus for determining performance -indicating numbers in sports games, particularly in ice hockey is turned on at a start switch and a first database is initialized to run, which simulates the start of a hockey game. The database is stored in random access memory as cells of matrix row and column data, such that a first row and column of a conventional sports game box score, of a database is stored as rows and columns and other rows and columns are stored as further rows and columns. Each row of data is read into a bus as a matrix. After initialization each cell of the respective rows are read into the bus. Intermediate statistics are determined electronically. The intermediate statistics , such as accrued time and power play goals, are determined for a variety of conditions, as described in formulae, which are then communicated to a calculator or computer for computation of final statistics. A time chart is then displayed. After data is processed, then the incrementer increments the database to further rows and columns and the further data is read

into the bus, and the intermediate statistics, the final
statistics and the visual display are again determined. The
incrementer continues to increment each subsequent row through a
series of rows, until the data are completely read onto the bus.
Then the intermediate statistics, the final statistics and the
visual display are again determined.

With the apparatus of the present invention, the performance
indicating statistics can be electronically displayed after a game
or during a game on the aforesaid tangible media, which may
include among others, a video split screen display during the
course of a game, a sports arena electronic scoreboard, or on any
other video display, such as a global communications network or a
television show.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood in referring to the
accompanying drawings, in which

FIG. 1 shows a plan view of a typical timing sheet, prior to
use;

FIG. 2 is a fragmentary cross-section of the timing chart of
FIG. 1, which is engaged with a cross-section of a representative
tape, according to the present invention;

FIG. 3 is a fragmentary plan view of the apparatus, according
to the present invention;

FIG. 3A is an enlarged view of FIG. 3;

FIG. 4 is a sideview of the arrangement shown in FIG. 3;

FIG. 5 is a close up side view of the arrangement shown in FIG. 4;

FIG. 6 is a plan view of a longitudinal carriage, and corresponds to FIG. 1, but with its top cover removed,

FIGS. 6A and 6B show a cross-section of a de-activated, and activated solenoid, respectively,

FIG. 7 is an isometric view of a clutch/brake;

FIG. 8 is a left side view of the clutch/brake of FIG. 7;

FIG. 9 is a schematic view of the clutch/brake of FIGS. 7 & 8, with the driving solenoid energized;

FIG. 10 is a schematic view of the clutch/brake of FIGS. 7 & 8, with the driving solenoid de-energized;

FIG. 11 is a schematic diagram of a length measurement sensor, or digital planimeter, according to the present invention;

FIG. 12 is a perspective view of the digital planimeter, whose block diagram is shown in FIG. 11,

FIG. 12A is a perspective view of a front end of a digital planimeter similar to that of FIG. 12, except that it plugs into a stationary transducer assembly provided in the carriage, according to the invention.

FIG. 13 illustrates the various paths the digital planimeter, according to the present invention, can traverse, without its reading being influenced thereby;

FIG. 14 is a block diagram of the drive and control unit according to the present invention;

FIG. 15 is a flow chart for the OFFSET mode operation, according to the present invention;

FIG. 16 is a flow chart for the LENGTH mode operation, according to the present invention;

FIG. 17 is a portion of a marked-up timing chart, according to the present invention;

FIGS. 18, 18A, 18B, 18C, 18D and 18E show examples of the apparatus in use, in plan view as in FIG. 3.

~~Figure 19 is~~ FIGS. 19A-19F, when joined at connectors A-A through J'-J' and match lines K'-K', show a block diagram of an apparatus 110 for determining performance-indicating numbers in sports games, particularly in ice hockey;

~~Figure 20 shows~~ FIGS. 20A and 20B, when joined at match lines A-A, show a database stored in a random access tangible media, describing a box score showing a running clock display throughout the game, with reference to both teams playing the hockey game;

~~Figure 21 is~~ FIGS. 21A and 21B, when joined at match lines A-A, show a database stored in a random access tangible media,

describing intermediate statistics generated by the apparatus 110
for determining performance-indicating numbers in sports games,
particularly in ice hockey, using the box score of ~~Figure 20~~ FIGS.
20A and 20B;

~~Figure 22 is~~ FIGS. 22A-22D, when joined at match lines A-A
through D-D, show a database stored in a random access tangible
media, describing final statistics generated by manipulating the
intermediate statistics data of ~~Figure 21~~ FIGS. 21A and 21B; and

~~Figure~~ FIG. 23 ~~is~~ shows a database stored in a random access
tangible media, describing a final display configuration
perceptible by a user.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As has already been pointed out, it is an object of this
apparatus, according to the present invention, to analyze specific
aspects of the present game, in this instance ice hockey.

This is done in order (1) to rate a selected team based on
its performance in different aspects of the game, and (2) to rank
the team accordingly, such as by the sum of the different aspects
of (1).

Referring now to FIG. 1, there will be seen a typical timing
sheet or chart 20, prior to being used. On its ordinate, as seen
in this Fig., there are shown periods of the game, i.e. periods

into which the same has been subdivided, while on its abscissa,

there may be shown two columns, for teams normally opposing one

another, such as teams A and B, when that chart is in use.

FIG. 2 shows a cross-section of the chart 20, where its front

surface is shown to be formed with a plurality of ridges 22.

Mating with the ridges 22 is a special tape 29, formed with ridges

22' on each side, which mate with the ridges 22 on the front

surface of the timing chart 20, though only one set of ridges 22'

mate with other ridges 22 at a given time.

FIG. 3 is a fragmentary plan view of the apparatus, with its

cover on, according to the present invention, while FIG. 4 is a

side view of the apparatus, as already shown in the fragmentary

plan view in the FIG. 3. To the timing chart 20 there will be seen

attached a mounting or alignment frame 34. Holes 21 are provided

at both ordinates of the timing chart 20 at periodic intervals,

corresponding in real time to intervals of one sec. Corresponding

bores 21' are provided in the mounting or alignment frame 34, and

the mounting or alignment frame 34 is attached to the timing chart

20 by means of pegs 27 at integral minutes lines. Near the top of

FIG. 3 there is shown a U-shaped attachment and alignment bar 38,

also mounted on the mounting and alignment frame 34. Outer members

44 of the U-shaped bar 38 are not visible, since they are mounted

within the alignment frame 34 in such a fashion as to permit the

U-shaped bar 38 to be spaced from the mounting and alignment frame

34. Members 40 pointing away from a first (horizontally movable) travel frame 35 are joined by a horizontally extending member 41' to complete the U-shaped first travel frame 35. A second travel frame 36 is nestled within the members 40, and is slidably arranged within the first travel frame 35.

The member 41' of the first travel frame 34 is provided with a (non-illustrated) bore, so that the alignment bar or rail 38 can pass therethrough, so as to make the first travel frame 35 slidable on the bar 38.

The second travel frame 36 is provided with tape dispensing control means, such as a key pad 28, on which there are arranged 10 numeric keys denoted from "0" to "9". Also arranged on the second travel frame 35 is a miniature display 32.

A plurality of function buttons 30' to 30"" are also arranged on the second travel frame 36, provided with corresponding display lights 37' to 37"" disposed next to the corresponding function buttons. (Please note that for the sake of clarity only key representative buttons have been shown, so as not to "overload" the drawing.) Above the miniature display 32, as seen in FIG. 3, there are arranged tape selection means, such as a tape selector mechanism, of which only a longitudinal slot 48, and a tape selector knob 45 movable therein are shown, which items will be discussed later. Downwards of the longitudinal slot 48 "marking

means" in the form of two additional and smaller "marking slots" 46 are provided.

Through the latter it is possible to mark-up the longitudinal timing chart 20 by means of marking instruments, such as a pencil or a pen, when the carriage is suitably positioned on the timing chart 20.

FIG. 3A is an enlarged view of FIG. 3, while FIG. 4A is a general sideview of the arrangement shown in FIG. 3, but also showing the relative locations of the two travel frame, and of the attachment and alignment frame, according to the present invention.

FIG. 5 is also a sideview of the apparatus, according to the present invention, but with its side cover removed. From FIG. 6, described later, it will be seen that the arms 102, form guide means 50 in the form of a fork or U-shaped bracket.

That fork partly encircles the tape dispensing wheel 31. From guide means 50 the assembly leads to a vertically ascending and bent tape-selection shaft 44 and therefrom to a shifter guide 43. The shifter guide 43, as seen in FIG. 5, is secured to the frame 64 of the carriage, and is provided with detents. The shaft 44 ends up in a free end capped with a tape selector knob 45. Linear bearings 42 and 42' urge the tape selection shaft 44 leftwards, i.e. towards the carriage frame 64, so that the tape moving shaft

44, when moved by its top knob 45 within the longitudinal slot 46

(shaft 44 pointing here into the paper, or outward therefrom)

leftward or rightward, and towards and into a selected indent 49

extending at right angles thereto, tends to stay there, until the

reel or tape selection knob 45 is shifted again to another tape

33. Selection of a tape is accomplished by tape selection means,

namely by the afore-described guide means 50. Each of the arms 102

is provided with a polygonal, preferably square hole or opening

104, through which there passes a generally polygonal, and

preferably square and stationary reel-moving shaft 56.

It will be seen that the tape dispenser wheel 31, formed with

ridges equivalent to those in a representative tape 29, will

engage a representative tape reel 33, even when shifted on its

usually square reel-moving shaft 56. (While the reel moving shaft

56 is square, its continuation 76, beyond the fork-carrying

portion, is round.)

The aligned arms 102 can horizontally slide, as best seen in

the following FIG. 6, on the reel-moving shaft 56, and are

additionally supported by a generally stationary support-shaft 55.

The gear wheel 31 can then be positioned opposite a selected one

of the reels 33'--33"" by operating the tape selecting knob 45.

FIG. 6 then is a plan view of the present invention, but with its

top cover removed. It will be seen to contain a longitudinal

carriage 23, with its top cover removed, carrying tape dispensing

means, such as reel holder 63, on which there is located the tape-dispenser 25 adapted, in turn, to carry a plurality of tape reels 33' to 33"", and other equipment.

It will be seen that the tape dispenser wheel 31, formed with ridges equivalent to those in a representative tape 33, will engage a representative tape 29, even when shifted on its usually square reel-moving shaft 56.

The additional equipment is primarily converting means, or converting apparatus, for obtaining the intermediate data from the statistical data. These are the tape holding means, such as a tape holder 25, so that its center axis or axle is positioned in parallel with the second axis of the timing chart 20.

The tape holder 25, is, in turn, adapted for carrying at least the already mentioned tape reels 33' to 33"". The latter carry corresponding tapes 29' to 29'", which are differently identifiable, respectively, such as by separate colors.

Also provided are tape unrolling means, wherein a representative tape 29 (embodying, for this example, one of the tapes 29' to 29""), moves in translation, so as to unwind that tape 29 from a representative reel 33. The representative tape 29, in turn, is driven by reel coupling means, such a as toothed wheel 31 in engagement with the representative tape 29. The tape dispensing or translatory moving wheel may be, for example, located on the same shaft as one clutch/brake, i.e. on shaft 76.

The tape dispensing or moving means, as has already been outlined, is preferably implemented as a toothed wheel or gear wheel 31 having ridges 22, in contact with corresponding ridges 22' of a selected (representative) tape 33. The gear wheel 31 therefore has ridges, or teeth, designed to mesh with other ridges on the tape 29; it is, in turn driven by an endless chain or belt 66, which is in operative contact with a pulley 81 of an electric motor 60, having a shaft 61'.

Upstream of the tape dispensing wheel 31 there are provided second tape guiding means, such as tape guides in the form of brackets 90, so that the tape 29 is guided along its path along the floor of the carriage 25 without curling upwardly.

Further downstream there is provided an exit slot 98 in the floor of the carriage, so that the tape 29 can pass therethrough in an orderly manner.

The exit slot 98 is bordered upstream by a wedge 91, permitting the tape 29 to slope downwardly. Further downstream, and beyond the exit slot 98 there are provided tape restraining means, such as an elastomeric pressure pad 88, whose task it is to prevent the tape 29 from passing through the exit slot 98 in an upwardly direction. Above the exit slot 98 there are provided cutter means, including blade guide means 91, which houses the solenoid 70, and therebelow a blade guide 94 as well as a retractable blade 92, which latter includes the cutting means,

i.e. it serves to cut off a predetermined length of the tape 29.
The blade 92 is command-actuated. Adhesive means are also
provided, i.e. the tape 29 with its ridges 22' is then shifted
onto the timing chart 20.

Thus its ridges 20 mate with the ridges 22' on the tape 29,
and stay put, thus implementing both the aforesaid adhesive means,
and the engagement means between the timing chart 20 and the tape
unrolling means.

Upstream of the exit slot 98, below the representative tape
29, provision is made for a transducer assembly 83, mounted on the
floor of the carriage, which includes a stylus 100, making in turn
contact with the tape 29 passing therebelow, and is feeding a
piezo- or magnetic-transducer 102, which is, in turn, followed by
a pulse shaper 114.

As can be seen from FIG. 5, the transducer assembly 83 is
provided at its output with two slots 122, serving as a
nonconducting receptacle. Still further upstream beyond the
transducer 83, and still below the representative tape 29, there
is provided a pair of drive wheels 51 and 53, which wheels come
into play when either the OFFSET or LENGTH mode operations are
selected.

FIGS. 6A and 6B show a cross-section of deactivated, and
activated solenoids, respectively. A plunger/shaft 78 is normally,
in the deactivated state of the solenoid 70, held back by a

restrainer spring 72 secured between the soft-iron armature 74 and the solenoid-housing 71.

When the solenoid 70 is activated, an electro-magnetic coil 77 urges the solenoid 70 to make contact therewith, so as to extend the plunger/shaft 78 outwardly.

The solenoid 70 is corporated into electromagnetic clutch means, and respective parts of electromagnetic clutch/brake means are shown in FIGS. 7 and 8, while the operation of a typical clutch/brake is clearly illustrated in FIGS. 9 and 10. FIG. 9 shows a clutch brake with the drive solenoid de-energized while FIG. 10 shows it with the solenoid energized.

A typical clutch/brake is composed, as shown in FIGS. 9 and 10, of a solenoid 70 having a retractable plunger/shaft 78 with a splined shaft 79 extending therefrom outwardly. The plunger/shaft 79, in its energized mode, is encircled by a cylindrical housing 71 rigid with the solenoid 70, followed by a first abutment disk 69, which has an end friction surface 80 facing away from the solenoid 70.

The first abutment disk 69 is followed, in turn, by a brake/clutch disk 73, which also has a splined bore, so that it can only slide on the splined shaft portion 79. Each lateral side of the brake/clutch disk 73 has a friction clutch surface, and the brake/clutch disk 73 is followed by a second abutment disk 84, which generally corresponds to the first abutment disk 69, but

which has a smooth bore, so as to be rotatable on the shaft

portion 79. An end surface thereof, facing away from the solenoid,

is then followed, in turn, by a timing-belt pulley 81, locked,

when the clutch is engaged, with the second abutment disk 74,

which has, in turn, in that mode, a drivable shaft 76.

When the solenoid 70 is energized, the brake/clutch disk 75

is forced to be in contact with the timing belt pulley 31, and it

is therefore engaged, so as to drive the output shaft 76; when,

however, the solenoid 70 is de-energized, the brake/clutch disk 73

is forced against the friction surface of the first abutment disk

69, and the pulley 31 is free-wheeling; as shown in FIGS. 5 and 6,

a clutch/brake is used in two places. One location is to couple

power from the gear motor 60 to the drive shaft 76', and the other

location is to couple power from the same gear motor 60 to the

shaft 76 coupled to the tape dispensing wheel 31. In an alternate

embodiment the two abutment disks can be omitted, provided that

suitable replacement friction surfaces are provided on the

components adjoining the brake/clutch disk 75, an end surface of

the solenoid 70, and an end surface of the timing belt pulley

facing the solenoid. The gear motor 60 is coupled to the

clutch/brakes 52, 54 via timing belts 66, as can be seen from

FIGS. 5 and 6. The operation of the tape dispensing unit 25

requires that either the drive wheels 51 and 53 are powered, while

the tape dispensing wheel 31 is stationary (i.e. Offset mode), or

that the drive wheels 51 and 53 are powered in synchronism with

the tape dispensing wheel 31 (i.e. Length mode). Since this action

is under micro-controller control (see FIG. 14), an electronically

controllable clutch is operationally required to selectively

engage the tape dispensing wheel 31. A clutch, however, is not

operationally required on the drive wheel shaft, since the drive

wheels are energized in either mode.

Consideration of the insidious effects of inertia, however,

dictate either an elaborate speed control to slow the motor 60,

when approaching a destination, or the introduction of an

electronically controlled brake, large enough to quickly dissipate

the considerable rotation inertia.

A third and better solution, i.e. the one adopted here, uses

identical clutch/brakes as interfaces between the gear motor drive

and both the shaft 76 driving the drive wheels, and the shaft

driving the tape dispensing wheel.

An almost instantaneous stop is required when the destination

is reached to limit overshoot to less that one half a unit timing

step. This is achieved on both axles by first of all selecting a

relatively slow speed of motion and tape dispensing for the tape

dispenser.

The speed is limited to 25 mm/sec or less by a judicious

choice of gear reduction in the gear motor 60. Thus the linear

inertia of the tape dispenser is minimal, even though its weight

is substantial. By using lightweight drive wheels, the inertia of the drive wheel/drive wheel shaft is kept low. The inertia of the motor armature and gear train, along with the timing belts and pulleys, however, is substantial. If clutches can be used to isolate these elements from the shafts driven by them in a small instant of time--a few milliseconds--the high inertia components can slowly coast to a stop.

The inertial energy is dissipated in component friction, while having no effect on the driven shaft or shafts.

But if the clutch can also serve as a brake, which is applied to the attached shaft at the same moment as it isolates the shaft from the drive, the low inertial energy of the shaft and its attachments is very quickly dissipated in even a small brake element. This is the operational nature of the clutch/brakes herein described.

A low inertia brake/clutch disk 73 is forced through an abutment disk 75 against the side of the timing belt pulley 61 driving the output shaft 76, when the solenoid is energized. When de-energized, the afore-mentioned restraining spring 75, which is integral with, or is connected to the plunger, shuttles the same brake/clutch disk 73 back a small distance to force it against a stationary friction surface of the abutment disk 69, where inertial energy is converted to heat by virtue of kinetic friction, thus dissipating the inertial energy.

Turning now to FIG. 11, that Fig. will be seen to show a block diagram of a digital planimeter. A stylus 100 is its input sensor, followed by a piezo- or magnetic pick-up 102, which is in turn followed by a pulse shaper 114. The latter three items, instead of filling a longitudinal shell or chassis, can alternately be combined to form a stationary transducer 83, which is mounted on the carriage 23, as shown in FIGS. 5 and 6, and which is formed with recesses 122, into which can be plugged the plugs 120, shown in FIG. 12A. A separate output assembly 103, as can again be seen from FIG. 11, includes a BCD counter 115, a grounded reset button or switch 116, one free end of which is connected to a reset lead 105, which, in turn, feeds the counter 115. Upon the reset lead 105 being grounded, the counter 115 is reset to a count zero.

The counter 115 is followed by a BCD 7 segment converter and driver 118, itself fed by the counter 86. The output of the counter 115 feeds the previously mentioned miniature display 32. The outward appearance of the digital planimeter is shown in FIG. 12. The physical shape of the output assembly 86', i.e. a truncated length measurement means, is shown in FIG. 12A, comprising substantially a longitudinal cylinder, which at its input end is fitted with two prongs 122, designed to be plugged into the slots 122 of the stationary transducer assembly 83.

The output assembly 86', when plugged into the transducer assembly 83, then constitutes a fixed length measurement means 86. The output assembly 103 will then be seen to constitute conversion means for changing a previously mobile length measurement means to stationary length measuring means. The aforedescribed length measurement means will pick up only "bumps" with its stylus 100, i.e. the ridges of the tape 29.

Such a design of length measurement means, i.e. of a digital planimeter, has the advantage particularly noteworthy in this application, that it can generally advance in a forward direction without incurring any change in the length measurement detected. This is illustrated in FIG. 13. Here a distance "d" is measured via paths A, B, C and D. Only path D, which has a reverse position and velocity component would provide a misleading indication.

In operation, the mounting and alignment frame 34 is placed on the timing chart 20 so that its two attachment pegs 27 are inserted into the appropriate holes 21 in the timing chart 20. Next the Starting Point, or first travel frame 35 is slid on the rail 38 of the mounting and alignment frame 34, and shifted to the desired location on the timing chart 20. A second travel frame 36 is then slid between the rails 40 of the first travel frame 35 so as to be moved upwardly. If the operation is simply to make an accurate pen mark, the OFFSET button is pressed, and the OFFSET indicator will light up.

Then the desired number of steps, i.e. seconds, of OFFSET are entered using the keys 30 of the manual keypad 28. (If an error is made, the RESET button is pressed, and the procedure is started again.) When the desired OFFSET appears in the display unit or miniature display 32, the START button is depressed. At this point, the second travel frame will automatically move a distance corresponding to the number of OFFSET steps, i.e. seconds, desired.

Now a pen can be used in one of the side windows or marking slots 46 to make an accurately placed mark on the timing chart 20. If tape were to be dispensed from this OFFSET starting point, the LENGTH KEY would be depressed, and the LENGTH MODE indicator would light.

Now the desired tape length, using the numeric keypad 28 is entered. The shift or tape selection knob 45 is now used to select the desired tape color or reel, and then the START button is again depressed. At this point the second travel frame 36 moves forward the desired amount, while laying down the desired length of tape in the desired location.

FIG. 14 is a block diagram of the drive and control means of the present invention. Its operations are controlled by a micro-controller 110. A read-only memory (ROM) controls its operation according to an OFFSET flow chart, shown in FIG. 15, and according to a LENGTH flow chart, shown in FIG. 16. Reverting to FIG. 14,

after the desired OFFSET mode, or LENGTH mode have been selected, they are entered into the numeric keypad 28 by pressing the corresponding buttons.

As in the aforesaid motors the carriage 23 is required to travel to its selected location; in these modes the motor driver stage then drives the D.C. gear motor, until the binary distance counter, which is fed by the transducer making contact with the timing chart, signals via the pulse shaper that in decrementing the count, zero has been reached; this information is passed in decoded form on to the micro-controller via an OR gate and an inserter. Concurrently that information is also fed to the LCD display via the LCD drivers, and to the solenoid via the solenoid driver. The solenoid then acts on the cutting blade 92 for cutting off the tape. During this time the magnetic clutch acting on the tape dispensing wheel 31 has also been activated. When, however, only driving wheels 51 and 53 are to be activated, only the magnetic clutch leading to the drive wheels 51 and 53 is energized.

FIG. 15 shows a self explanatory-OFFSET flow chart. First the OFFSET start button is depressed, and the OFFSET indicator set. The numeric keypad is then set, the display in the LCD indicator is read, and copied into the binary distance counter. After the START button is depressed, the drive-wheel clutch is set to zero. (In the event the START button has not been depressed, or is

malfunctioning, the device returns its earlier mode.) Subsequently the DRIVE-WHEEL clutch is set to DRIVE, and the TAPE-DISPENSING clutch is set to zero. The motor is started, and if an INTERRUPT signal has been received, the DRIVE-WHEEL clutch is set to BRAKE. The OFFSET indicator is then reset.

FIG. 16 shows the LENGTH flow chart, which is, in fact, also self-explanatory. Initially the LENGTH start button is depressed, and the LENGTH indicator set. The numeric keypad is then set, and the display in the LCD indicator is read, and copied into the binary distance counter. After the START button is depressed, the DRIVE-WHEEL clutch is set to DRIVE. (in the event the START button has not been depressed, or is malfunctioning, the device returns to the mode in which the binary distance counter is displayed). Subsequently the TAPE-DISPENSING and DRIVE WHEEL clutches are set to BRAKE. The motor is started, and if an INTERRUPT signal has been received, the DRIVE-WHEEL clutch is set to BRAKE, so that the motor is stopped, and a pulse to the TAPE-CUTTER solenoid is sent to start cutting of the tape. The LENGTH indicator is then reset.

FIG. 17 shows how the results of a particular game are used.

PROCEDURE FOR PLOTTING GOALS

A. The mounting and alignment frame 34 is placed onto the timing chart 20 with reference marks at 3 minutes. The first

travel frame 35, holding the second travel frame 36 is moved
horizontally to the desired position. The OFFSET button is
depressed, "19" is entered, and then the START button is
depressed. A pen is used to make an appropriate mark through
either of the pen slots 46.

B. Thereafter the mounting and alignment frame is placed at 4
minutes. The first travel frame 35, holding the second travel
frame 36 is emplaced and moved horizontally.

The OFFSET key is depressed, "25" is entered, and then the
START key is depressed, and the timing chart 20 is marked, pushing
a pen through one of the slots 46.

C. Then the mounting and alignment frame is placed at 7
minutes. The first travel frame 35, holding the second travel
frame 36 is emplaced and moved horizontally. The OFFSET key is
depressed, "7" is entered, and the START key is depressed, and the
timing chart 20 is marked, pushing a pen through the other slot
46.

PROCEDURE FOR PLOTTING PENALTIES

Points D & E. The mounting and alignment frame 34 is placed
at 2 minutes. The first travel frame 35, holding the second travel
frame 36 is emplaced and moved horizontally. The OFFSET key is
depressed, "16" is entered; then the START key is depressed; then

the LENGTH key is depressed, "120" entered, and now the START key

is again depressed.

Points F & G. The mounting and alignment frame 34 is placed

at 3 minutes. The first travel frame 35, holding the second travel

frame 36 is emplaced and moved horizontally. The OFFSET key is

depressed, "7" is entered, then the START key is depressed; then

the LENGTH key is depressed, "300" is entered, and now the START

key is again depressed.

Points H and I. The same above-noted procedure is used, with,

with the OFFSET key at "56", and the LENGTH key at "120".

After the entire game has been entered, hockey rules for

infringements are looked for; the rules are discussed in more

detail in the section of the rules governing ice hockey in the

appendix of this application. Changes may have to be made in the

starting and ending times of some penalties. If a penalty is cut

short, this can be shown by crossing out the tail end with a pen,

using the digital planimeter 86, or the motorized first and second

travel frame units 35 and 36 to assist in locating the appropriate

points. To change the starting point of a penalty, the old tape is

pulled off, and the new penalty is replotted at the correct

starting point, as in the above-outlined procedures.

EXAMPLES OF SCORING USING APPARATUS OF INVENTION

Power play for team "A" is penalty efficiency for Team "B".
The tape dispenser includes tapes of respective multiple covers.
With regards to "Legend" each noted situation is displayed as
follows:

Example A:

Line #6: Team "A" is awarded a 2-minute power play at the 4:10
mark of the first period. Team "B" is charged 2-minutes of penalty
time.

1) Place Alignment and Attachment bar to the 4-minute mark.

2) Place tape dispenser on alignment bar.

3) Adjust dispenser horizontally to Team "B" side.

4) With tape dispenser at starting point frame, (4-minute mark)
hit offset button; key in on number pad "10" seconds; hit start.

5) Use digital tape dispenser to cut a blue tape strip from the
4:10 mark on timing chart for penalty time for Team "B". Hit
lengths; enter "120" seconds on number pad for the two minutes of
potential power play time; hit start. Cut tape. The one man

penalty time tape for Team "B" is now on timing chart. Before Team "A" can score a goal, they are assessed a penalty of their own at 4:29. The following procedure would apply.

Example B:

Line #6: Team "A" is charged with a 2-minute penalty at the 4:29 mark of the first period.

6) Place Alignment and Attachment bar to the 4-minute mark on Team "A" side.

7) Place tape dispenser on alignment bar.

8) Adjust dispenser horizontally to Team "A" side.

9) With tape dispenser at starting point frame, hit offset button; key in on number pad "29" seconds; hit start.

10) Use digital tape dispenser to cut a blue tape strip from the 4:29 mark on the timing chart for penalty time for Team "A". Hit length, enter "120" seconds on number pad; hit start. Cut tape.

The one man penalty time tape for Team "A" is now on the timing chart.

11) Using pen tip, run horizontal line through Team "B" penalty tape strip at beginning of penalty tape strip for Team "A" (4:29). Using pen tip, run a horizontal line through Team "A" penalty tape strip at ending of Team "B" penalty (6:10).

Had this sequence been the only power play time in the entire game, the scoring would be as follows:

1) To account for Team "A" power play time using the planimeter, hit reset button; place planimeter at beginning of first penalty of game, (4:10) Team "B". Move planimeter down blue penalty tape strip "unit time" ridges track to pen line. Read planimeter. LCD now displays accrued one man seconds/time and composite power play seconds time for Team "A"0 for entire game which would be 19-seconds.

2) To account for Team "B" power play time using the planimeter, hit reset button; place planimeter at pen line on Team "A tape strip (6:10). Move planimeter down blue penalty tape strip "unit time" ridges to end of tape (6:29). LCD now displays accrued one

man seconds/time and composite power play seconds/time for Team

"B"0 for entire game which would be 19-seconds.

The events of this game would affect equations D,E,I,J,K,L and M

for both teams power play. The events would effect equation

P,Q,U,V,W,X and Y for both teams penalty efficiency.

Example C: 1 & 2

Line #10: Team "A" is awarded a two minute power play at the 4:10

mark of the first period. Team "B" is charged two minutes of

penalty time.

1) Place Alignment and Attachment bar to the 4-minute mark.

2) Place tape dispenser on alignment bar.

3) Adjust dispenser horizontally to Team "B" side.

4) With tape dispenser at starting point frame, (4-minute mark)

hit offset button; key in on number pad "10" seconds, hit start.

5) Use digital tape dispenser to cut a blue tape strip from the

4:10 mark on timing chart for penalty time for Team "B". Hit

length; enter "120" seconds on number pad for the two minutes of potential power play time; hit start. Cut tape. The penalty time tape for Team "B" is now on timing chart. Team "A", having failed to score, is then awarded an additional two-minute power play at the 5:40 mark, or 30 seconds before the first two-minute power play would expire.

6) Place Alignment and Attachment bar to the 5-minute mark.

7) Place tape dispenser on alignment bar.

8) Adjust dispenser horizontally to Team "B" side.

9) With tape dispenser at starting point frame, (5-minute mark) hit offset button; key in on number pad "40" seconds; hit start.

10) Use digital tape dispenser to cut a black tape strip from the 5:40 mark on timing chart for two player penalty time for Team "B". Hit length; enter "30 seconds on number pad or remaining first penalty time; hit start. Cut tape. The two player penalty time tape for Team "B" is now on timing chart.

11) Using pen tip, run horizontal line through Team "B" first penalty strip equal to beginning of second penalty (5:40).

12) When the two player advantage for Team "B" expires (6:10), place Alignment and Attachment bar at 6:00, then repeat step 2 through 5 using blue tape to complete remaining one player time of second penalty (6:10 to 7:40).

Had this sequence been the only power play time in the entire game, and no goals were scored, the scoring would be as follows:

1) To account for Team "A" power play time using the planimeter for one man time on blue tape only; hit reset button; place planimeter at beginning of first penalty of game, (4:10) Team "B". Move planimeter down blue penalty tape strip "unit time" ridges track to pen line (5:40). Lift planimeter off timing sheet. Place planimeter at beginning of second blue penalty tape strip (6:10). Move planimeter down "unit time" ridges track to end of second blue penalty tape. Read planimeter. LCD now displays accrued one player seconds/time for Team "A". To account for Team "A" power play time using the planimeter for two man time on black tape only, hit reset button; place planimeter at beginning of second penalty of game, (5:40) Team "B". Move planimeter down black penalty tape strip "unit time" ridges track to where black tape ends. Remove planimeter off timing sheet. Read planimeter. LCD now displays accrued two man seconds/time for Team "A".

Had this sequence been the only power play time in the entire game, and no goals were scored, the scoring would be as follows:

2) Team "B" would have no power play time in this game. The events of this game would affect equations D,E,G,H,I,J,K L and M for Team "A" power play. The events would effect equation P,Q,S,T,U,V,X and Y for Team "B" penalty efficiency.

Example D:

Line #4: Team "A" scores a power play goal in 25-seconds. Team "A" is awarded a two minute power play at the 4:10 mark of the first period. Team "B" is charged 2-minutes of penalty time. Team "A" scores a power play goal at 4:35 of the first period or 25-seconds into the 2-minute penalty assessed to Team "B" at 4:10. Team "B" penalty time ends at 4:35, when Team "A" scored power play goal.

1) Place Alignment and Attachment bar to the 4-minute mark.

2) Place tape dispenser on alignment bar.

3) Adjust dispenser horizontally to Team "B" side.

4) With tape dispenser at starting point frame, (4-minute mark) hit offset button; key in on number pad "10" seconds; hit start.

5) Use digital tape dispenser to cut a blue tape strip from the 4:10 mark on timing chart for penalty time for Team "B". Hit length; enter "120" seconds on number pad for the two minutes of potential power play time; hit start. Cut tape. The one player penalty time tape for Team "B" is now on in the timing chart.

1) Place Alignment and Attachment bar on timing chart with reference marks at the 4-minute mark.

2) Place tape dispenser unit within starting point frame on Alignment and Attachment bar.

3) Move dispenser horizontally to Team "B" side.

4) Hit offset button, then enter "10" seconds and hit start.

5) Use pen tip within pen slot in tape dispenser to make appropriate mark
(4:35).

Had this sequence been the only power play time in the entire game, and the only goal scored, the scoring would be as follows:

1) To account for Team "A" power play time using the planimeter for one player time on blue tape only, hit reset button; place planimeter at beginning of first penalty of game, (4:10) Team "B". Move planimeter down blue penalty tape strip "unit time" ridges track to pen line (4:35). Lift planimeter off timing sheet. Read planimeter. LCD now displays accrued one player seconds/time and composite one player seconds/time for Team "A" (25-seconds).

The events of this game would affect equations B,C,D,E,I,J,K L and M for Team "A" power play. The events would effect equations N,O,P,Q,U,V,W,X and Y for Team "B" penalty efficiency.

Example E:

Line #17: Team "A" is awarded a two minute power play at the 4:10 mark of the first period. Team "B" is charged two minutes of penalty time.

1) Place Alignment and Attachment bar to the 4-minute mark.

2) Place tape dispenser on alignment bar.

3) Adjust dispenser horizontally to Team "B" side.

4) With tape dispenser at starting point frame, (4-minute mark) hit offset button; key in on number pad "10" seconds; hit start.

5) Use digital tape dispenser to cut a blue tape strip from the 4:10 mark on timing chart for penalty time for Team "B". Hit length; enter "120" seconds on the number pad for the two minutes of potential power play time, hit start. Cut tape. The one player penalty time tape for Team "B" is now on the timing chart. Team "A" is then awarded an additional two-minute power play at the 5:40 mark, or 30-seconds before the first two-minute power play would expire.

6) Place Alignment and Attachment bar to the 5-minute mark.

7) Place tape dispenser on alignment bar.

8) Adjust dispenser horizontally to Team "B" side.

9) With tape dispenser at starting point frame. (5-minute mark) hit offset
button; key in on number pad "40" seconds; hit start.

10) Use digital tape dispenser to cut a black tape strip from the 5:40 mark on timing chart for two player penalty time for Team "B". Hit length; enter "30" seconds on number pad or remaining first penalty time; hit start. Cut tape. The two man penalty time tape for Team "B" is now on the timing chart. Team "A" then scores a power play goal at 5:45 while on a two man advantage.

1) Place Alignment and Attachment bar on timing chart with reference marks at the 5-minute mark.

2) Place tape dispenser unit within starting point frame on Alignment and Attachment bar.

3) Move dispenser horizontally to Team "B" side.

4) Hit offset button, then enter "45" seconds and hit start.

11) Use pen tip within pen slot in tape dispenser to make appropriate mark (5:45).

12) Using pen tip, run horizontal line through Team "B" first penalty strip equal to beginning of second penalty (5:40).

13) The two man disadvantage for Team "B" expires at 5:45, or when

Team "A" scored at 5:45. Place Alignment and Attachment bar at

5:00; then repeat step 2 through 5 using blue tape to complete

remaining one man time with starting time at 5 minute mark and

offset at 45-seconds (5:45 to 7:40). Team "A" then fails to score

in the remaining 1:55 of penalty time assessed to Team "B" at

5:40.

Had this sequence been the only power play time in the entire

game, and one goal was scored, the scoring would be as follows:

1) To account for Team "A" power play time using the

planimeter for one player time on blue tape only, hit reset

button; place planimeter at beginning of first penalty of game,

(4:10) Team "B". Move planimeter down blue penalty tape strip

"unit time" ridges track to pen line (5:40). Lift planimeter off

timing sheet. Place planimeter at beginning of second blue penalty

tape strip (5:45). Move planimeter down "unit time" ridges track

to end of second blue penalty tape. Read planimeter. LCD now

displays accrued one player seconds/time for Team "A" 3 minutes

and 25 seconds. To account for Team "A" power play time using the

planimeter for two player time on black tape only; hit reset

button; place planimeter at beginning of second penalty of game,

(5:40) Team "B". Move planimeter down black penalty tape strip

"unit time" ridges track to where black tape ends (5:45). Remove planimeter off timing sheet. Read planimeter. LCD now displays accrued two player second/time for Team "A" five seconds.

The events of this game would affect equations B,D,E,F,G,H,I,J,K,L and M for Team "A" power play. The events would effect equations N,P,Q,R,S,T,U,V,W,X and Y for Team "B" penalty efficiency.

In the preferred embodiment of the invention, an apparatus for determining performance-indicating numbers in sports games, particularly in ice hockey, includes a database having sports games box scores stored therein. The database is stored in a tangible electronic media, such as magnetic media, optical media, electronic media, paper, thermosetting polymers, rubber, metals, or other suitable storage media. Such media includes computer diskettes, magnetic tape, optical disks, random access memory, read only memory, computer punch cards, and other volatile, temporary, and/or permanent memory devices. The database scores box scores, such as start time, stop time, team 1 goals and time of goals, team 1 goalies A and B goals and power plays, and team 2 goalies A and B goals and power plays.

As shown in ~~Figure 19~~ FIGS 19A-19F, the apparatus 110 for determining performance -indicating numbers in sports games, particularly in ice hockey is turned on at start switch 112 and a first database 114 is initialized to run by incrementer 116, which

simulates the start of a hockey game. The database 114 is stored

in random access memory as cells of matrix row and column data,

such that row 1, column 1 of box score 118, shown in ~~Figure 20~~

FIGS. 20A and 20B, of database 114 is stored as D_{11}, row 1, column

2 is stored as D_{12}, and row m, column n is stored as D_{mn}. Each row

of data is read into bus 120 as a matrix of cells D_{11} through D_{mn}.

After initialization each cell of row 1, i.e., D_{11} through D_{1n},

represented as $D_{11}...D_{1n}$, is read into the bus 120. A second

database 122 of intermediate statistics, as shown in ~~Figure 21~~

FIGS. 21A and 21B are determined and stored in random access

memory, as shown in the block diagram of ~~Figure 19~~ FIGS. 19A-19F,

which will be further described. The second database intermediate

statistics 122, accrued time and power play goals are determined

for a variety of conditions, as described in formulae 1-10, which

are then communicated to a calculator or computer for computation

of final statistics 124 as shown in ~~Fig. 22~~ FIGS. 22A-22D. A time

chart is displayed based upon display 124 shown in ~~Figure~~ FIG. 23.

   After data $D_{11}.....D_{1n}$ is processed, the incrementer 116

increments the database 114 to row 2 and data $D_{21}...D_{2n}$ is read into

bus 120, the intermediate statistics 122, the final statistics 124

and the visual display 126 are again determined. The incrementer

116 continues to increment each row through Row m and, until the

data $D_{11}....D_{1n}$ through and $D_{m1}...D_{mn}$ are completely read onto the

bus 120, and the intermediate statistics 122, the final statistics 124 and the visual display 126 are determined.

With the apparatus of the present invention, the performance indicating statistics can be electronically displayed after a game or during a game on the aforesaid tangible media, which may include among others, a video split screen display during the course of a game, a sports arena electronic scoreboard, or on any other video display, such as a global communications network or a television show.

Now, in more detail, as shown in ~~FIG. 19~~ FIGS. 19A-19F, the start switch 112 initializes and turns on timer 128 at substantially the same time as the incrementer 116 is initialized. After initialization, the data cells $D_{11}...D_{1n}$ are read from the database 114 onto the bus 120 and routed from the bus 120 for processing by appropriate circuitry to be herein described. Each of the cells $D_{11}...D_{1n}$ is processed by the circuitry before the incrementer 116 increments to the next row of the database 114.

Elapsed game time-out (D_4) is routed to comparator 130. When the time generated by the timer 128 reaches the time indicated by the elapsed game time-out (D_4), the comparator 130 turns trigger 132 on, which transmits a trigger pulse to the incrementer 116, which then increments the database 114 to row 2, and so on, until row m is reached.

Power play time begin(D_5) is routed to comparator 134. When the time generated by the timer 128 reaches the time indicated by the power play time (D_5), the comparator 134 turns trigger 136 on, which transmits a trigger pulse to AND gate and AND gate 140. If there is a signal present from NOT gate 140, then the trigger pulse from the trigger 136 is sent to programmable timer 142 as a start pulse, which starts the programmable timer 142.

Maximum length power play time in minutes (D_6) is routed to the programmable timer 142 and is used to set time duration of the programmable timer 142, such that the programmable timer 142 runs for the duration of maximum length power play time in minutes (D_6).

Penalty, in this case for Team 2 (D_{13}), is routed to storage device 144, which stores the penalty (D_{13}) until the power play time begin (D_5) begins.

During the time that the programmable timer 142 is running and the penalty, for example for Team 2 (D_{13}) is routed to AND circuits 146 and 148, time in minutes and seconds are accrued in adders 150 and 152, respectively. The accrued time in minutes and seconds is routed from the adders 150 and 152 to cells designated as accrued time P and accrued time Q in database 152 for intermediate statistics stored in random access memory, respectively. The incrementer 116 increments rows of each of the respective databases 152 and 114 in synchronization one to the other, such that as data is read out of a row, for example row x,

of the database 114, manipulated data is read into row x of the database 152.

If a goal is scored, for example for Team 1, then elapsed game clock all goals scored (D_7) is routed to comparator 154, such that the comparator 154 has an output at the time indicated for the goal scored (D_7) when the timer 128 output, which is also routed to the comparator 154, reaches the time indicated by D_7.

Power play goal by team number (D_2) and the output of the comparator 154 are routed to AND circuit 156, which resets the programmable timer 142, when a power play is scored by Team 1.

D_7 and D_2 are also routed to AND circuit 158, which routes an output signal to Goal N for Team 1 in the database 152 for intermediate statistics.

If there is a two player penalty, then programmable timer 160 is activated substantially the same manner as the programmable timer 142, and two player advantage statistics are routed to the database 152.

Additional programmable timers (not shown) and associated circuitry (not shown), which is substantially the same as the aforedescribed programmable timers and associated circuitry, for one player and player advantages and goals of the opposing team are incorporated into the apparatus 110 for determining performance -indicating numbers in sports games, particularly in ice hockey.

The intermediate statistics from the database 152 may be optionally manipulated by a computer and/or calculator to arrive at final statistics for the hockey game.

A time chart display may be optionally displayed on a cathode ray tube, monitor, or television showing goals scored as the ordinate and with respect to time during each period as the abscissa.

Thus, the present invention provides an apparatus and method for obtaining selected performance statistics, for example, of one or more teams engaged in competitive hockey scores, by extensive manipulation of time frame statistics, from a game box score, generally provided by newspapers. The present invention achieves this manipulation automatically in a novel advantageous manner.

Other modifications may be made to the present invention, in other related environments, without departing from the spirit and scope of the present invention, as noted in the appended claims.